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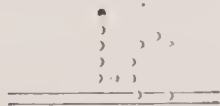
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ZOOLOGY, ORNITHOLOGY, ICHTHYOLOGY,  
ENTOMOLOGY, BOTANY, ASTRONOMY





## INTRODUCTION

### TO THE BEAST AND BIRD SECTION

By ERNEST THOMPSON SETON

*Author of "Wild Animals I Have Known," "The Trail of the Sandhill Stag," "Biography of a Grizzly," "Art Anatomy of Animals," "Mammals of Manitoba," "Birds of Manitoba," etc., etc., etc.*

"WHATEVER shall I do with my boy, he is just crazy to go a-hunting?" Such is the despairing question of many a mother whose heart is tender toward the Wildwood Folk, as well as loving and indulgent toward her vigorous, roustabout son.

It is a serious matter to tell a mother how to bring up her child, but the question is one of such importance and such recurring persistency that those who write on the ethics of hunting should at least attempt an answer.

First, the mother may rest assured that the fact of her boy wanting to go out and kill something does not by any means prove that he is a little reprobate. Indeed, observation inclines me to think that all boys who amount to anything afterward do pass through a period when they are "just crazy to go a-hunting."

We must remember that our ancestors have been hunters for many ages, so that the chasing instinct is very deeply ingrained. To hunt was their stern duty—their necessity, so that it became part of their natures.

We cannot expect to root out this age-old growth in one generation. We may be convinced that it is wrong to kill animals for sport,—that is, for the pleasures incidental to doing it,—but still we have the habit; it is inborn with every one of us, and is only to be conquered after a struggle. The stronger and more energetic the boy, the more likely is he to be a bloodthirsty little savage, during that time of life when he is passing through the Stone Age epoch—from nine to sixteen usually.

But what are we to do? This is certain, we cannot *crush* it out. It is always dangerous to attempt forcible crushing of a strong, natural, and not unhealthy craving. Usually the treatment would depend upon the boy. One general rule always holds good, that is, develop him,—get him through his seven years of savagery as fast as possible. Proper training may condense the seven years into half as long, just as improper may prolong it indefinitely.

Second, since this destructive energy is there and cannot be wholly stopped, we must divert it to a desirable channel. This is a well-known and sound principle of economics. That desirable channel seems to be what we call Nature Study.

Nature study is so nearly in the same line as hunting, that it is the easier to substitute. It fosters all the fine art of woodcraft without the

brutalities. The more a boy follows woodcraft and learns the beauties and interest of wild life, the less he will be disposed to destroy that life.

This will apply to most boys, but there will always be a few who will not rest satisfied with anything short of real hunting—real killing for sport. Here again it is hard to know what to do; but I think it may be the right thing to let such have one taste of it. Keep the boy back as long as possible, at least until well into his teens, then let him have a little of the chase. Few boys that have ever seen a beautiful harmless wild animal shot down—needlessly done to death, will ever again feel the same way about sport. It may not end their desire for it, but it certainly will set them thinking.

It must not hastily be assumed that sport is wholly brutal and degrading. On the contrary, there is much about it that is elevating and developing. If it were not so, we should have abolished it long ago, as we did the arena and the bull-ring. The healthy outdoor exercise and surroundings, the contact with nature's beauties, the pleasure of pursuit, that is, the matching of one's wits with those of the animal, the exhilaration and excitement of that competition, all are good things. The bad things are the unnecessary cruelty and destruction.

I should not say much about these at present, but that the destructive ingenuity of man is so active that he has made it possible for an irresponsible small boy to annihilate the most rare and magnificent animals, and consequently many beautiful and valuable creatures are threatened with extinction. Therefore all thoughtful people should do their utmost to stop this extermination—to prevent the obliteration of a national heritage that properly preserved would supply pleasure to all generations.

And this we can do only by sternly repressing the coarser forms of the murdering mania and then diverting the remaining energy into better, higher channels—above all, as already suggested, the channel of nature study, that is, the intimate, friendly study of the natural objects about us, the study that follows and learns to use the eyes and the understanding, instead of the gun,—that realizes that life is precious; that the living bird in the bush is a wonderful, beautiful, mysterious creature, and the dead bird in the hand has lost most of what made the living bird so precious.

But there is an important craving in human nature, that must be kept in view. However convinced we may be that it is wrong to kill, however purely scientific may be our interest, however superior to the slaughtering mania,—the blood-madness,—no one who studies anything is wholly satisfied without more or less possession. He wants to see it close at hand, to touch it, to own it. That is a natural and a really justifiable inclination, to stop which would be to greatly hamper the knowledge seeker. Here again it may be best to allow the feeling some measure of vent. But if this is done, there is one rule that should be applied rigidly to all killing or collecting of birds, beasts or fishes—nothing should be wasted.\*

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\*Of course I am not now speaking of vermin, that is, certain animals that have become numerous and so noxious as to be a pest, but of the ordinary wild creatures about us.



If killed for food, they should be carefully and unwastefully used for food. Or if killed in the name of science, they should be wholly, and to the best advantage, devoted to scientific purposes.

For example, if your boy shoots a woodpecker under plea that he is studying natural history, we may accept his plea at its face value. Perhaps this justifies him. But if so, he is bound to get all the natural history he can out of the specimen to atone for the destruction of life. I would always insist that he skin, or, in some way, fully and permanently preserve it, and that he further make it of value by attaching to it a label stating when and where he killed it.

This is really of vast importance. First of all, it makes the boy's excuse a reason. Second, it limits greatly the possible amount of destruction. Third, it directs his attention to the beauties of the creature he killed. Fourth, it really kindles and feeds his interest in natural history, and, last, it adds to our knowledge of the creature.

Here perhaps the mother may stop and incredulously ask: "How is it possible for us beginners to lend aid to science?"

To this I should say: There are many departments in which only the expert can make further advance; but in the matter of nature observation, all who have eyes to see and tongue to tell can be of assistance.

To everyone there come rare opportunities to learn—chances to see into some mystery that has baffled all others. One never knows what they may be or how they may come; but a thousand instances might be cited to prove the statement.

Not only do facts come, but rare specimens turn up in odd ways. I once saw a milk snake disgorge a jumping mouse, and so learned for the first time that this mouse was found in that region; and I gave lasting value to the observation by preserving the mouse's body in alcohol.

The value of a single nature study observation does not seem great, or even real. And yet we have always found that those who were storing up little scraps of truth were providing building material for some noble structure that they themselves had no conception of. It always has been so, and it always will be so. Those who in the past blindly gathered up the little facts in natural history were unconsciously making possible our modern science of Pathology and Sanitation, and so relieving mankind of a weight of woe.

So those who continue the good work, making careful investigations of visible nature, are helping us to comprehend the laws we live under, and are preparing the way for some new, great boon to mankind.

It will be seen from this that I attach special value to the object lesson in nature study. All educators do. Viewed from any point, the actual thing, the specimen presented, is worth far more than the statement that such an object exists.

I would have every boy and girl interested in nature study, collect and save the specimens that appealed to him, or that come in his way. Specimens labeled with date and place are the best and largest facts. But to

preserve them takes time and trouble. So much the better. On p. 235 will be found full instructions for preserving birds and beasts. Of course it will be remarked that this is starting the boy in the direction of making a museum,—a home museum. Why not, if his tastes lie that way? It is the safest corrective of the hunting craze. Most boys have the mania for collecting. With some it may take the form of postage stamps, and, with others, business cards or autographs. This is another case where the energy is awaiting ready produced and it is wise to turn it to the most useful channel.

If the house affords no facility for the boy's museum, and few homes do not, there is in nearly every town to-day a public museum that will be glad to receive the boy's contributions, tell him the names and properly care for them.

Furthermore, be it remembered, that sport is not wholly bad, but, as already indicated, there is in it much that is good. If we could get sport without the bad parts, we should have a diversion to be cherished always. It seems that we can do so. We can now get all the elevating influences without the brutality, by what we call the New Hunting. The weapon of the new chase is not the gun, but the camera. The camera has come forward as the animal's friend, and to this extent the mother's friend, for it enables her to divert the boy's attention from the savagery to the fine art of the chase, without turning him into a molly-coddie.

Another important side to the subject is the literature. Sporting literature has had much to do with keeping hunting and killing in good repute, and it is, in part, to regenerated sporting literature that we must look for the cure. It is quite easy to stock the boy's library to-day with books of the better sporting kind, books which foster woodcraft and woodlore without glorifying slaughter, and yet without outraging the child whose keenly discriminating instincts resent the nauseating pills of over-strong morality slightly coated with natural history. It is not necessary to wholly exclude books that treat of sport in the ordinary sense, but it is well to remember that wild-lore is the main thing,—the important safety valve for the sporting energy, and that by teaching the boy the rudiments of woodlore, we can add to his life a great and lasting pleasure to replace the much smaller and lower pleasures of hunting.

If all children lived in the country and had no opportunities to see any but the animals and plants of their own land, I should confine their studies largely to those. But it happens that half our children live in town where they have access to museums, pictures and collections of birds, beasts, fishes, plants and natural curiosities from all parts of the world, and I should, therefore, lead each child in the direction of a general knowledge of the strange creatures of the globe, remembering always that the object lesson is the best of lessons, and that when the object is not at hand, a good picture of it is the next best thing.

This plan is the one now commended by the educator, as well as by convenience, and sustained by the choice of the child. This, therefore, is the method adopted by the projectors of THE CONSOLIDATED LIBRARY.



In this volume (IV), I have edited carefully the sections devoted to mammals and birds.

Sound science, corrected in the light of the latest researches, is the basis of all the articles, but this necessary substructure, or, at least, any possibly repellant and technical features, are kept out of sight, and light, but trustworthy accounts are given of all those things that are likely to first catch the eye and attention of a growing child of healthy mind and body.

The part devoted to the animals, as children usually call the beasts or mammals, comprises eighty-two pages, with twenty-three colored illustrations. The text is from the pen of Mr. Frank Roe Batchelder, the well-known naturalist. The accounts are given in simple language and the picturesque side of each animal, the side likely to appeal most to the reader, is duly kept in front.

The number of birds treated by Mr. Batchelder is yet larger. One hundred and thirty in all are described, forty-four illustrated.

I have read every word of these articles and can guarantee the general statements throughout. The animal stories are by several well-known writers. I have gone over them, and while I assume no responsibility for style or scope, I can vouch for the accuracy of the lessons conveyed.

The proper field of this work is to give a brief, popular digest of any subject, and then to refer the reader to the works necessary for exhaustive research. The best works for further guidance in taxidermy, bird-photography, and the natural history of our country, are:—

Blanchan. "Bird Neighbors." Published by Doubleday, Page & Co. Price \$2.00.

Blanchan. "Birds That Hunt and Are Hunted." Published by Doubleday, Page & Co. Price \$2.00.

Blanchan. "Nature's Garden." Published by Doubleday, Page & Co. Price \$3.00.

Chapman, F. M. "Bird Life." Published by Appleton & Co. Price \$1.75.

Chapman, F. M. "Handbook of Birds of Northeastern America." Technical and popular. Published by Appleton & Co. Price \$3.50.

Coues, E. "Key to North American Birds." Full descriptions of all North American birds, their nests, etc. Both technical and popular. (Second and third editions.) Published by Cassino. Price \$8.00.

Dana. "How to Know the Ferns." Published by Charles Scribner's Sons. Price \$1.50.

Darwin. "Insectivorous Plants." Published by D. Appleton & Co. Price \$2.00.

Davies, O. "Birds and Eggs." North American birds.

Dugmore. "Bird Homes." Published by Doubleday, Page & Co. Price \$2.00.

Grant. "Our Common Birds." Published by Charles Scribner's Sons. Price \$1.50.

Holland. "Butterfly Book." Published by Doubleday, Page & Co. Price \$3.00.

- Hornaday, W. T. "Taxidermy." Full, authoritative treatise on the art of taxidermy. Published by Charles Scribner's Sons. Price \$2.50.
- Jordan, D. S. "Manual of Vertebrates," a technical work, describing all the beasts, birds, reptiles, amphibia and fishes in Eastern North America. Published by McClurg & Co., of Chicago. Price \$1.75.
- Keeler. "Our Native Trees and How to Identify Them." Published by Charles Scribner's Sons. Price \$2.00.
- Lounsbery. "Guide to the Trees." Published by F. A. Stokes Co. Price \$2.50.
- Lounsbery. "Guide to the Wild Flowers." Published by F. A. Stokes Co. Price \$2.50.
- McCook. "Tenants of An Old Farm." Published by G. W. Jacobs & Co. Price \$1.50.
- Merriam. "Birds Through an Opera Glass." Published by Houghton, Mifflin & Co. Price 75 cts.
- Merriam, C. H. "Mammals of the Adirondacks." A work giving life histories of all the beasts or mammals in the Adirondack region. Without descriptions. Published by Henry Holt & Co., of New York. Price \$2.00.
- Miles. "Natural History." Published by Dodd, Mead & Co. Price \$1.50.
- Miller. "Bird Ways." Published by Houghton, Mifflin & Co. Price \$1.25.
- Miller. "In Nesting Time." Published by Houghton, Mifflin & Co. Price \$1.50.
- Miller. "Little Folks in Feathers and Fur." Published by E. P. Dutton & Co. Price \$2.50.
- Parkhurst. "Bird's Calendar." Published by Charles Scribner's Sons. Price \$1.50.
- Roberts, Charles G. D. "The Heart of the Ancient Wood." Published by Silver, Burdett & Co. Price \$1.50.
- Rowley, Jno. "Art of Taxidermy." An excellent guide. Published by Appleton & Co. Price \$2.00.
- Seers. "Fur and Feather Tales." Published by Harper Bros. Price \$1.75.
- Thompson Seton, Ernest. "Wild Animals I Have Known." Published by Charles Scribner's Sons. Price \$2.00.

## ZOOLOGY

**Z**OOLOGY is the science which treats of the structure, functions, distribution and classification of all animal life. The science is consequently divided into: Structural, Physiological, Geographical, and Systematic Zoology. The structure of animals furnishes the material for the study of Comparative Zoology, Anatomy and Physiology. All of these are subdivisions of the greater study of life in all its forms, called Biology. The entire group of animal life in a country or subdivision of land is the fauna of that land. The study of the fossil remains of animals is the branch called Paleontological Zoology. There have been several classifications of animals into groups, notably those of Aristotle, Linnæus, Cuvier, Lamarck, Agassiz and Darwin. The classification of animals is the underlying basis of Darwin's theory of evolution. The starting point in this theory is, that, as great changes in animals and plants can be brought about by cultivation, breeding, and placing in new conditions to which the animal or plant can adapt itself, a change or transmutation of species is possible. In 1858, Darwin read before the Linnæan Society, a paper entitled "On the Tendencies of Species to Form Varieties, and on the Perpetuation of Species and Varieties by Means of Natural Selection." This paper was the result of twenty years of study of natural history. Much of his information was acquired during a voyage around the world with Captain Fitz-Roy's expedition on the "Beagle" during the years 1831-1836. On the voyage he learned facts which could be explained only by his theory that animals become gradually modified and changed to suit the environment, and become, in time, beautifully adapted to their habits of life. This was his theory of Natural Selection. To further support it he sent out inquiries to breeders and gardeners, read extensively, and collected facts bearing upon the subject. He came to realize the struggle for existence that is going on everywhere in nature, and he saw that in that struggle the tendency is for favorable species and varieties to be preserved and unfavorable ones to be destroyed. This resulted in his enunciation of the "survival of the fittest" in the "struggle for existence." In this way new species must be formed. About 1842 he had his theory fairly well developed and sketched an outline of it, which he showed to Lyell, Hooker, and other scientists.



He was not ready to give it to the world in its incomplete state, but devoted several years of hard study to the problem. In the meantime Alfred Russell Wallace had been working independently upon the problem in the Malay Archipelago and in 1858, the year in which Darwin read his paper, Wallace sent to Darwin his theory of evolution. Had it not been for the influence of his friends, Darwin would have generously published Wallace's paper and have withheld his own life-work of research. Then Wallace's paper "On the Tendency of Varieties to Depart from the Original Type" was read along with Darwin's before the Linnæan Society. This was the announcement to the world of the theory of Natural Selection. In 1859 Darwin published his book, "The Origin of Species by Means of Natural Selection; or the Preservation of Favored Races in the Struggle for Life." It was met at once by a storm of antagonism and adverse criticism, but gradually Lyell, Hooker, Huxley and Tyndall adopted it and endorsed it. Darwin, Wallace, Spencer, Huxley and Tyndall are known as the apostles of evolution. Darwin was a great collector of facts and data; Spencer was the philosopher with an encyclopedic knowledge; Huxley had the courage of his convictions; and Tyndall was the orator. Evolution is opposed to the belief that all the different species of the world were created as a separate type; but holds that all the varieties have sprung from a few simple forms of life modified, changed, and evolved as circumstances have directed. If all of the animals that are born survived; if all of the millions of eggs laid by fish hatched out and matured, the earth would be overrun. But this multiplying of species is checked in the struggle to survive, and only the best or fittest of each species mature. In conformity to the theory of evolution tables of classification of animals, which were formerly placed in a descending scale from man as the highest in the type, are now reversed and begin with the lowest forms of life and ascend to the higher and later forms of life.

All animal life is classified under two heads. The Vertebrata and the Invertebrata. The basis in this case is simply whether or not the animal has a bony column composed of several independent articulations of vertebræ or divisions of the spine.

VERTEBRATES.—The highest group of vertebrates is the Mammalia. They are warm-blooded, air-breathing animals, with a more or less hairy body. The young are born alive except in the case of some of the lowest which lay eggs; but the young of all are nourished by milk supplied by the mammæ, or breasts of the mother. The majority live on dry land; others, like the whale and seal, live in the water; and the muskrat and beaver swim well. They are usually found in

groups or societies. The skull contains the brain, and the backbone supports ribs. There is much greater uniformity in the number of bones than might be expected. The long neck of the giraffe and that of a man consist of exactly the same number of bones, but varying greatly in size. They have usually four limbs, two anterior and two posterior. They also have as a rule five digits, though some of these may be present in an undeveloped state, as the claws on the dog or cat and the unused toes of the pig and horse. The hind legs of the seal and whale have entirely disappeared, and the fore legs take the rude form of flippers. The digestive system is upon the same plan as that of man. The most notable feature of the nervous system is the large and well-developed brain.

The highest of the order of Mammals are the man-like Mammals or Primates and include Man, Monkeys, and Lemurs.

The Flesh-eating Mammals or Feræ rank next and include Cats, wild and domestic, Dogs, Coyotes, Wolves and Foxes, Skunks, Bears, Seals, Lions, and Tigers.

The Hoofed Mammals, or Ungulata, include Zebra, Elephant, Hippopotamus, Giraffe, Deer, Horses, Cattle, Sheep, Goats, Pig, Moose, Elk or Wapiti, Caribou, Antelope, and Buffalo.

The Whales and Porpoises or Cete, include Dolphin and Grampuses.

The Bats or Cheiroptera.

The Insect-eating Mammals or Insectivora include Moles.

The Rodents or Gnawers include Rats, Mice, Squirrels, Gophers, and Rabbits.

The Opossums and Kangaroos or Marsupialia.

The Sirenia or Sea-cows, and Dugong.

The Edentata, or Ant-eaters, Armadillos and Tree-sloths.

The Monotremes or Dutch-mole, the Ornithorhynchus of Australia.

## THE HORSE

THERE is a great deal of doubt as to the country from which the Horse first came. Some say Asia, others Africa, and still others Europe. The Bible tells us that horses were in use in Egypt in very early times. Drawings of horses have been found scratched upon bones by the earliest savages of Europe; and the bones of horses have been found mingled with the remains of men who lived in Europe before history was written.

The natural state of the horse was a wild state. Troops of wild horses have roamed over the level plains of Russia for centuries; and they yet do in parts of both North and South America. In this



country they are caught by hunters and Indians, who lasso them and tame and train them. When the Spaniards came to America, shortly after the year 1500, they brought horses with them in their ships. And nearly all of these wild horses are the descendants of that importation. Since that time a great many valuable horses have been brought into the country from abroad. The young of the horse is a colt or foal. The oddest thing about colts is, that although we have a great many white horses, no one ever saw a white colt. They are always darker in color, and one can never tell what the color will be, until they have shed the first coat of hair, which they do during the first year. A colt looks very awkward and ungraceful because its legs are very long in proportion to the rest of the body. A foal is called either a colt or a filly, according to sex.

Horses are divided into classes, under two heads. One, according to the country from which they come. So we speak of the Arabian, the Norman, the Percheron, the French, and so on. The other division is based upon the purposes for which they are especially bred and for which they are best fitted. Then we speak of them as, Draught or Cart horses, Carriage horses, Saddle-horses, Hunters, Runners, Trotters and Pacers.

There have been a great many famous horses in history. The Arabian is probably most noted for its handsome appearance and great speed. The devotion of it for its master and the love of the masters for it have been celebrated both in song and story for centuries. Alexander the Great had a famous horse, named Bucephalus, which he alone could ride. He took it with him on his conquest of the world into Asia, and, when it died, he gave it a magnificent funeral. It was probably not a handsome horse for its name means in Greek, oxheaded.

Draught or Cart horses are bred for strength and size. The Norman, or Percheron, as it is often called, came from Perche, a district in the north of France. They are of large size and powerful build. The French use them as artillery horses for hauling heavy cannon, and also for heavy coach work. They can pull great loads, but do not run fast, because they are so heavy. They often weigh between 2,000 and 3,000 lbs. Many have been imported into the Western States of America. They are usually dapple-gray in color, and are great mountains of flesh.

The Clydesdale and the Suffolk Punch are bred from the enormous dark or black horses of Flanders and are much esteemed for draught and for farm uses. The Flemish horses were in great favor as chargers in old times when knights and soldiers wore the heavy suits of armor and the horses were protected by metal shields. When gun-



powder came into use in war, and the armor was laid aside as it was no protection against bullets, a lighter, nimbler horse was used. But the Flemish and the Arabian have laid the foundation of all good horses.

In the days of hunting and hawking in Europe the lady's palfrey was bred from the Spanish genet, a small, beautiful, swift-footed Moorish horse. The Hunter and the Race-horse are mainly derived from the Arabian blood.

The more of the Arabian stock there is in a horse, the more "blood," or "breeding" he is said to have. Great care is taken in the breeding of horses. The state of Kentucky has long been famous for its fine breed of fast horses.

A mustang is the name given to the wild horse of America. When it is unbroken or only partially broken, it is called a bronco, and from its habit of gathering its four feet close together and arching its back suddenly in its attempts to free itself of its rider, it is called a "bucking" bronco.

An undersized horse is called a pony. The small growth seems to be due to the severity of climate and the scarcity of food. The most noted are the Shetland ponies, from the Shetland Islands, north of Scotland; and the Sable Island ponies, from the island south of Nova Scotia, in the Atlantic Ocean. These latter are the descendants of the horses which were left on the islands by French explorers early in the sixteenth century. Horses are measured by a length called a hand. It is a measure of four inches, the average width of the palm. Horses are measured at the fore shoulder. Any horse under thirteen hands or 52 inches is called a pony. Some of the Shetland Island ponies are not more than 36 inches high; and many much smaller than that have often been exhibited.

The horse has six well-defined gaits: the walk, the amble, the pace or rack, the trot, the canter and the gallop. These different motions have all been studied under the moving-picture camera. In a walk a horse has always two and sometimes three feet on the ground at the same time. The order in which he puts his feet down while walking is: right hind, right fore, left hind and left fore.

The amble is a rapid walk. The foot is not on the ground for so long a time, and sometimes there is only one foot, and sometimes two feet on the ground at the same time.

The rack or the pace consists of the motion of bringing forward the right fore and the right hind leg at the same time.

The gallop is produced by putting forward both fore legs at the same time. There are intervals when the horse is not at all supported.

The trot is an artificial gait in which the horse puts forward the right fore and the left hind leg at the same time. Some horsemen maintain that the movement is not exactly simultaneous and that there is a brief interval during which the trotter has always one foot on the ground.

The horse is a remarkable example of the complete subjection of a high-spirited, wild animal to the will and, too often, to the brutality of man. The patient suffering of the noble, useful animal from neglect and ill-usage is horrible to contemplate. Among the commonest forms of cruelty to the horse is the tight check-rein, designed to make him hold his head up in a stylish way. This is especially hard upon horses going up hill. A horse hauling a heavy load up a hill naturally puts his head down as he advances his feet and body in pulling. Check-reins should always be loosened on climbing a hill, if they are used at all. Some use them because without them the horse might take the liberty of nibbling an enticing bite of grass from the roadside, or green from the hedge.

The burr-bit is an atrocious attachment of sharp-pointed tacks to the side of the bit. It is intended to prick the horse's mouth and cause him, from pain and annoyance, to toss his head and champ his bit in a fashionable way.

The countless instances of horses being left standing unblanketed in cold weather after hard driving while the driver is comfortably housed beside a warm fire are only too familiar. The way in which a man treats a helpless, hampered horse, may be taken as a fair indication of his character.

The fiendish invention of goads, brads, whips, and such instruments of torture used upon the horse reflects but small credit upon our civilization. They are principally used to overcome not the viciousness or unwillingness of the horse, but the driver's indiscretion or laziness in overloading beyond the horse's strength on bad roads. We perhaps might respect the horse more if he would rebel more frequently against unjust and cruel treatment by inflicting justly deserved punishment upon his tormentors. We certainly do respect the self-defense of the cat, who, however affectionate it may be under good treatment, is quite ready to resent cruelty, tooth and claw.

Although the horse is so well-known to all, it may be stated that the chief points of difference between it and other animals are: a flowing mane and tail; small, erect ears; large rounded hoofs of one piece; a fine shaped head and an arched neck; a peculiar voice called a "neigh"; and a hard callous growth on the inner side of the hind leg corresponding to one on the fore leg. It is a mammal of the Equidæ family, of the genus *Equus*, and its scientific name is *Equus*



Caballus. It has passed through different stages of evolution during the several geological periods, and extinct species are known as: the Eohippus, Orohippus, Mesohippus, Miohippus, Pliohippus and Hipparion.

## DONKEY

THE Donkey, Ass, or Jackass is a native of Asia and Abyssinia. It has been under subjection to man from time immemorial. Its characteristics are its long ears; its peculiar voice, or "heehaw"; the absence of long hair, except a small tuft at the end of its tail; and the callous wart-like growth that is found on the inner part of the hind leg of a horse is wanting. In other respects it resembles a small horse. Its color is usually gray, though white and black varieties are common. It has a cross-like mark of color on its shoulders. The size of the Donkey seems to be dependent upon the care that it receives, as well as upon the rigor of the climate. The fact that it will eat thistles causes it to receive very often the coarsest kinds of food. In some parts of India, where it is neglected, it is often no larger than a Newfoundland dog; while in Spain where it is bred with the greatest care, its height has been increased from 13 to 14 and 15 hands. Great attention is given to it in the state of Kentucky, for the raising of mules.

The Donkey is sure-footed, which makes it of great service in rough countries. It is of slow gait and great patience. In Persia it runs wild and is hunted for food. Its flesh there is valued as we value venison. The hide is tanned to make the leather called shagreen. The peculiar graining of the shagreen is artificially produced by pressing into the leather the seeds of a plant called Chenopodium, then shaving the surface, and by soaking the leather, causing the indentations made by the seeds to swell up in relief. The green color is imparted to the leather by ammonia and copper. Ass's milk is very nutritious and is often used in cases of weak digestion.

## CATTLE

THE original of the many and varied breeds of cattle in the world to-day is supposed to have been an animal of pre-historic times to which the Romans gave the name of Urus. This monster roamed wild through the forests of Europe, and Cæsar tells us that it was almost as large as an elephant, but was in form and color like a bull. This story seems to be borne out by the discovery of the skull of one



of these animals in Atholl, in Scotland. It measures three feet long and the span between the core of the horns is 3 feet 6 inches.

From the earliest dawn of history, cattle were reared, herded, and formed the chief article of wealth of the people. This is evidenced by the worship of the sacred cow by the Hindus; the veneration of the bull Apis by the Egyptians; the offering of the hecatomb, a sacrifice of a hundred bulls, by the Greeks; the careful protection of the cattle by the Jews as laid down in the laws of Moses; and the severe penalties for their willful destruction among the Romans. The Latin word for cattle is "pecus"; and when the earliest coins were struck, they had a bull's head upon them; so money was called "pecunia" in Latin; and this gives us our word "pecuniary" and others.

Very great advance was made in the breeding of cattle during the 19th century. The heaviest cattle in England are the short-horns. And the first place among them has been held for a long time by the Durham, Teeswater, or Short-horn cattle. They grow large and very rapidly, and are easily fattened. They are of good-temper and pleasing appearance. Very early, the breeders of the United States saw their value and made valuable importations. From the superior advantages which the United States offered, the breeders were very soon able to improve upon the imported stock. Forty head of Short-horn known as the "Duchess" were sold by Mr. Sheldon, of Geneva, New York, in 1867, for \$42,300. In 1873, one of the same stock was sold for \$40,600, at auction. This was the "Eighth Duchess of Geneva." A calf, only eight months old, brought \$27,000. At this sale of Mr. Campbell of New York Mills, Utica, 108 animals sold for \$380,000.

The Hereford is another of the Short-horns that is much esteemed for beef; though the cows are not so good milkers as the Durhams and others.

The North Devon are of fine appearance, nice color and good-temper. They are used as ox-power in farm work.

Among the Scotch breeds are: the Aberdeen, Angus, and Galway. These are usually of a black color and hornless. They fatten easily, grow rapidly, and supply excellent beef.

All of these large cattle are raised especially for beef and are not such good milkers as others; although the Frisian-Holstein, introduced from Germany, combine beef and milk qualities to a high degree. They were imported into America in 1857. They are very large and are white with black patches.

Among the Dairy cattle are the Ayrshires, the Suffolk Duns and the Jersey. To the milk-seller, the chief points in a milch-cow are, a great quantity of milk, a long period of milk giving, and ease of



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fattening when milk-giving falls low. The butter and cheese maker pays more attention to the quality of the milk than to the quantity. The Ayrshire is unsurpassed for the dairy. They are large yielders in proportion to the quantity of food, and are easily kept. They have all the qualities of a good milker; wide pelvis, deep flank, enormous udder, and wide-set teats.

The Suffolk Duns are poor grazing cattle for beef, and are awkward and ungainly in appearance; but they are large milk-producers and are easily kept. They are of a pale brown or red color and are polled or hornless.

The Jersey comes from the Channel Islands and is a great favorite in private dairies on account of the great richness of the milk and cream. They are of most pleasing appearance, some of them possessing deer-like qualities. It was imported into America in 1850.

There are certain mountain cattle of Great Britain which include the Kyloes or West Highland cattle, Welsh cattle, Pembrokes, Anglesean and others. The Shetland cows, like the Shetland ponies, are the smallest animal of their kind in the world. When one of these is fattened its carcass is not much larger than that of a sheep. They give large quantities of milk in proportion to their size; and are well-suited for the bleak, cold, climate of those islands.

The general characteristics of the cow are hollow, persistent horns; head carried low on a short neck; hoofs hollow and divided; legs short; and tail tufted.

The Hungarian cattle are noted for very long horns; some measuring five feet from tip to tip.

The herds of wild cattle which roam over the Pampas of lower South America are said to be descended from eight Frisian animals taken from Spain to Asuncion, Paraguay, in 1556.

The cattle of the Hottentots and Kaffirs of Africa are very large and valuable. Some have been known of which the horns measured thirteen feet along the curve from tip to tip.

## DOGS

THE origin of the dog is a question upon which naturalists cannot agree. The most generally accepted opinion is that the dog as he is to-day in so many and varied species is the result of a mixture of many of the kinds of wild animals, especially the wolf, the jackal, and the fox. Many attempts have been made to classify the dog, but the members of this family are so variable that they soon outgrow a classification. Colonel Smith classifies them into six sec-

tions. (1) The wolf-dogs, in which he places the Siberian, the Eskimo, the Saint Bernard, the Newfoundland, the sheep-dog or Scotch collie, etc. (2) Watch and cattle-dogs. (3) The greyhounds. (4) The hounds. (5) The cur and (6) mastiffs.

The Siberian dog has long hair and tail, and small erect ears. It is remarkable for its gentleness and great powers of endurance. It is used as a sled-dog, for draught purposes over the snow.

The Eskimo dog is usually of a white color. It has long fine hair, and its tail is curled tightly upon its back. The ears are small, erect, and pointed. The nose or muzzle is sharp and fox-like. It, too, is used for draught purposes.

The Newfoundland dog takes its name from the island of Newfoundland, in British America. These dogs are long-coated and are heavy. They are excellent swimmers and many instances have been known where people have been saved from drowning by these dogs. Although they have originated within narrow limits of territory, they have become distributed all over the world. They are used for draught purposes. The milk-women in Holland use them to haul the little milk-wagons about the streets. They are often employed to run small motive powers, such as churns, etc. They are particularly faithful, intelligent, and affectionate.

The Saint Bernard dog takes its name from the pass of Saint Bernard over the Alps, in Switzerland. A monastery was established there, and those dogs have been trained to search for and bring in travelers who may become exhausted in the snow. This dog is very large, and one variety is long-haired and the other is short-coated. The Saint Bernard and the Newfoundland differ from the other wolf-dogs in that their ears are very long and hang down, instead of being erect and sharp-pointed. One of the dogs of Saint Bernard wore a medal upon which it was recorded that he had saved twenty-two lives. Their bark is very loud, in some instances it has been heard over a mile away. Both the Newfoundland and the Saint Bernard dogs are very high, usually about thirty inches at the shoulder.

The sheep-dog or Scotch collie has semi-erect, sharp-pointed ears, a pointed nose, and shaggy hair. In his work of tending and herding sheep he displays the greatest intelligence. He is usually about thirteen inches high, and his tail is curved and shaggy. The Scotch collie is the most intelligent and the purest bred of all sheep-dogs. His duties are very arduous and difficult, on account of the nature of the country and the great exactions made upon him. He understands a word or even a look from his master and promptly obeys it. He can do the work of several men in herding, gathering, and bringing in



large flocks of sheep scattered over a great extent of territory. Very often the sheep-dogs of South America are left in charge of sheep, miles away from any human being. While the qualities of watchfulness and driving cattle are possessed by many dogs, they are especially strong in this group.

The Danish, Dalmation, or coach-dog is, in appearance, mid-way between a hound and a pointer. He is short-coated and is white, covered with black spots. As he is not possessed of the quality of scent to a sufficiently high degree, he is kept about stables on account of his watchfulness. He is supposed to be of Indian origin.

The North American Indian dog is a heavy wolf-like dog much valued as a watch-dog.

The German boar-hound was formerly used for the hunting of the wild boar, but is now valuable as a cattle and watch-dog.

The greyhounds are found among the inscriptions and hieroglyphics on monuments of Egypt which date back 3000 years. Silky-haired varieties of the Egyptian dog are found in Egypt, Persia, and Arabia at the present day. Greyhounds are divided into two classes: the wire-haired and the smooth-haired. The older varieties of this dog that were to be found in Ireland, Scotland, and England, must have been more powerful and keen-scented dogs than those of to-day. It is now unrivaled in wind and speed, but has no scent and is the only dog that hunts by sight alone. It can run on smooth ground almost as fast as a race-horse, but can exceed it on rough ground. It is fitted by its build and shape for high speed. Its nose is long and pointed, head narrow and small, neck thin, chest deep, flanks contracted, legs long and slender, and tail narrow and curved. It is exceedingly good tempered and affectionate.

The Italian greyhound is small, elegant, and delicate. It is not used for hunting but is a house dog.

The Lurcher is a cross between a sheep-dog and the greyhound. He is much used by poachers in England. He is cunning, quiet, extremely intelligent and possesses keen scent. Hounds usually have long, hanging ears, close hair, long deep muzzle which indicates a keen scent.

Bloodhounds are rarely met with as pure bred dogs. They have long, hanging smooth ears, eight or nine inches long, full heavy muzzle, broad deep chest, powerful limbs, and a deep baying voice. They are remarkably keen scented and possess the quality of always keeping upon the original scent or trail upon which they start. They are much used on this account in tracing fugitives or criminals. These dogs were frequently used in war, especially between the early Scotch and English. The Cuban bloodhound differs much in appearance from



the English bloodhound. It has been used extensively in hunting runaway negro slaves in past days.

The Staghound is thought to be a cross between the slow southern hound and the swift-running foxhound. It is a majestic looking, powerful, fleet-footed dog; and has the keen, unerring, unswerving scent of the bloodhound. They are much rarer now than in the days of stag-hunting with dogs.

The Foxhound combines in a wonderful degree, good temper, perseverance, keen scent, swiftness, and strength. He is about twenty-one inches high at the shoulder and is white, marked with black or tan patches. He has been known to run four miles in seven minutes and keep up the chase for ten hours continuously. He is the dog that is meant when the word "hound" is used alone in England.

The Harrier is smaller than a foxhound, being only about eighteen inches high. They are used exclusively for hunting the hare.

The Beagle is a still smaller hound. It is the smallest of all the hunting dogs, being only twelve inches high. It has keen scent but its speed is not so great as that of the foxhound. This dog has a very musical bark, and for that reason a few are often included in a pack of foxhounds.

The Pointer is a hound of Spanish origin. He is a large, smooth-haired, compactly built dog. He takes his name from his habit of standing immovable on the scent of the game, with tail outstretched and one fore leg raised and slightly bent. His color is white with usually liver-colored patches. Daniel tells of two pointers that stood immovable as statues for an hour and a quarter while they were being sketched.

The Setter takes its name from the habit of crouching down as soon as he scents the game. He is very like a pointer in build, but differs from him in the length of his coat, which is long and silky. There are three kinds of setters: (1) The Irish, which is of a dark, rich mahogany color, (2) the English Gordon, which is black with red or tan marks on the head from neck to nose and on the lower part of the legs, (3) the English which is divided into the Llewellyns and Laveracks. The Llewellyns are black or white with liver, tan or lemon spots. The Laveracks are black and white. The black spots are sometimes very small and are not marked off with decided boundaries but blend in with the white hairs.

The Spaniel is a dog of English breeding although its name would seem to have some connection with Spain. They are medium and small in sizes. The chief characteristic of the Spaniel is that its hair, besides being long and silky is curly; markedly so upon the ears, face, head, and some parts of the body. It is of a timid, affectionate

disposition and is a good house-dog and pet. They are divided into, (1) Land-spaniels, (2) Water-spaniels and (3) Toy-spaniels. The Land-spaniels include the Cocker and Springer.

The Cocker is a characteristic Spaniel, either wholly black or brown. It is so named as it is trained to hunt woodcock in covers and snipe on the marshes.

The Springer is a small Spaniel of elegant form, usually white with red spots, black nose and palate. It takes its name from being taught to spring or flush the game, *i. e.*, to start it up. The chief breeds of Springers are Clumber, Norfolk, and Sussex.

The Water-spaniels are of two kinds, the large and the small. They differ from other Spaniels in the roughness of their coats and their fondness for water.

The Toy-spaniels include the King Charles, the Blenheim, the Maltese and the Lion dog.

The King Charles is a small black and tan Spaniel. It is remarkable for its straight forehead and short muzzle, which with its round prominent eyes gives its face an odd appearance.

The Blenheim resembles the King Charles but is white, marked with red or yellow.

The Maltese and Lion dogs are lap-dogs.

The Poodle is a small sized dog with long silky hair. They are of an affectionate disposition and are favorite pets, especially the French Poodle or Barbet.

The Terrier is a small, hardy dog, that takes its name from its habit of digging up the earth in search of its prey. They are very brave and their senses are very acute.

The Black-and-tan or English terrier is one of the oldest dogs of England. It is smooth-coated, compact, and muscular. Its muzzle is long and slender and its limbs slender and graceful, though strong.

The Scotch terrier is smaller, shorter-limbed and is covered with long wiry hair. The best known variety is the Skye terrier. They are famous ratters. One breed of Scotch terrier is the Yorkshire terrier. The Dandy Dinmont differs from this in that its legs are very short and its body very long.

The Maltese terrier is a small toy-terrier kept as a pet.

The Fox terrier is small, usually white with black and tan spots. It is kept for unearthing foxes by digging down into their underground homes.

The Terriers sometimes go by the name of rat-terriers. One of these was known to kill one hundred in seven minutes. Their method is to catch their prey by the back and, by a shake, to kill it instantly.



The Bull-terrier is a cross between the bull-dog and the terrier. They are the most obstinate and savage of all the terriers. They are usually of a brindle and white color, and possess many of the qualities of both kinds of dogs.

The Mastiffs have extremely short, broad muzzles, tremendous strength of jaw and powerful muscles. They include the Mastiff, the Bull-dog and the Pug.

The Mastiff, when pure-bred, is a noble looking animal, with large well-developed head, lips deep and hanging down at the sides. He is affectionate and a splendid watch-dog.

The Bull-dog is the most obstinate, savage and ferocious of all the dog-kind. He is also the least sagacious. He is smaller than the mastiff, but is very compactly built. He has all the characteristics of the family. Sometimes the under-jaw protrudes so that when his mouth is closed the under row of teeth are outside of the upper row. He is then said to be undershot. His fore legs are curved or bowed, the forehead rises sharply from the nose and the brows seem to scowl over the, usually, blood-shot eyes. His barrel is round, flank narrow, and chest broad and deep. His ears are semi-erect. He gives no warning of his attack by bark or growl, as other dogs do; and, when he once seizes an object or an enemy, no amount of pain or torture will compel him to relax. His color is either brindle, white, or black.

The Pug is very different in its disposition and temper from the bull-dog; but very like it in appearance. It is mild and affectionate and a favorite pet. It is remarkably dull of intellect.

## THE CAT

FOR more than three thousand five hundred years, Cats have been the pets and companions of men. The first Cats of which we know were those of the early Egyptians. Seventeen hundred years before Christ was born, the Cat was regarded in Egypt as a sacred animal, and the work of painters and sculptors remains to tell us of the proud distinction in which the people held him. There was a Goddess of Cats, called Pasht, and so highly were these animals regarded, that when they died their bodies were embalmed, like those of their owners. Within recent years, thousands of mummies of Cats have been discovered in Egyptian tombs.

The Cat is a pretty, graceful creature. He is very dignified and is quiet and slow in his movements, when he has passed the days of



kittenhood. A Cat does not ordinarily run, except to escape danger or to capture his prey.

Men who have studied the structure of animal's bodies, tell us that the Cat is more perfectly formed for his purpose in life, and is more powerful in proportion to his size, than any other quadruped. It is not hard to believe this, when we think of the great strength and agility of lions and tigers, which are only Cats of larger size.

A Cat's paw is full of interest, if we examine it closely. Ordinarily, it is soft and velvety, but if we press it gently, out come the sharp white claws that are concealed beneath the fur. The Cat has muscles with which he can push out or draw in the claws, at will. The dog's claws are quite different. They are blunt and strike the floor when the dog walks, so that they make some noise. But the Cat draws his claws when he walks, so they may not touch the floor, and he has a soft ball on the bottom of his feet, to make his tread noiseless; for nature has taught him to creep very softly near his prey, that he may not frighten it, before it is too late for it to escape.

The Cat's eyes are so formed that he can see well in places that seem to us quite dark. Our eyes have round holes in the center, which we call the pupils, but in the Cat's eye the pupils are narrow slits. When the light is very bright, the narrow slits become mere cracks, letting in very little light, but in the dusk the slits widen and the pupils of the Cat's eyes grow large and round. This lets in all the light there is.

The Cat has the delicate feelers which we sometimes call "whiskers," to guide him when he is in absolute darkness. The slightest touch on these feelers tells him to go cautiously, so he makes his way safely in dark places.

## SHEEP

**A**MONG the characteristic features of the sheep may be mentioned: that they are cud-chewers or ruminants, with hollow persistent horns. The way in which the horns are marked by ridges forms a basis of their classification. The horns curve and in the wild state both the male and the female have horns. The upper incisor and canine teeth are wanting as in the cow family, their places being taken by a hard pad against which the lower teeth bite. The skulls of these animals show that provision is made for considerable side-way movement of the lower jaw in chewing. The feet of the sheep are of hollow hoofs, which are divided into five parts. Only two of these touch the ground. The other divisions are imperfectly formed

and are placed higher up on the leg. On account of the great fleece of wool, the sheep seems to be a larger animal than it really is. The sheep is provided with a very keen sense of smell, and they trace their own tracks and those of others of their kind by an odorous substance which is secreted in a small sac or bag between the two middle toes. This is squeezed out at every step and taints the grass and stones upon which the animals step. The tail of the sheep is very short in the wild state but lengthens in the domestic varieties. It was a domestic animal and source of wealth in the oldest times, in the nomadic state of man which preceded that of the agricultural. The animal was unknown in America before its introduction by the Spaniards. It is now distributed all over the known world. There are very many varieties of wild sheep. It is found on the high plateaus of Asia 16,000 feet above the sea level; in the Rocky Mountains is found the Big-horn or Rocky Mountain Sheep. The sheep lives in a natural state in high places where it has developed wonderful powers of jumping and leaping. Its sharp cup-shaped hoofs make it very sure-footed. Though well-fitted by reason of its horns and sharp hoofs to protect itself in the wild state, it is, in the domestic state, the most timid and gentle of animals. Sheep are easily driven from their tendency to follow their leader.

Among the varieties now bred by farmers for the meat and wool are: Leicesters, Lincolns, Cotswolds, Teeswaters, Southdowns, Shropshires, Dorsets, Cheviots, Black-faced or Heath, and others of cross-breeds.

The wool of the sheep is the most important textile fabric next to cotton. The finest variety is the first clipping, or lamb's wool, which is clipped at the age of eight months. Later clippings are inferior in value. The wool clipped from the living sheep is superior to the skin wool of dead sheep. The best wool for years came from Spain, the home of the Merino sheep. These sheep have been bred into other varieties to the very great improvement of wool qualities. About 4,000 Merino sheep were imported into the United States in 1809, at a time when wool was \$2.50 a pound unwashed, and the Merino lambs were sold at \$1,000 each. In 1900 there were over forty million sheep in the United States. The average yield of wool per sheep in a year is about five pounds. Others run down to two pounds, and some have been known to yield fifteen pounds, but that is very unusual. The sheep are first washed a day or two before they are sheared, in order to remove the dirt from the fleece. A skillful hand will shear a sheep so as to keep the entire fleece in one piece or in an unbroken condition. It is then rolled up. This enables the sorter to pick out the different qualities of wool. The best



quality of wool, or No. 1, is generally on the shoulders and along the sides; No. 2 is on the front half of the back; No. 3 is from the loin, or the front of the rear half of the back; No. 4 is from the tail and hind quarter; No. 5 is from the belly; No. 6 is from the throat and breast; and No. 7 is from the legs. The wool of the sheep is saturated with a greasy, oily substance known as lanolin. It is used as a basis for ointments instead of lard.

## THE PIG

THE Pig has been in a domesticated state since the earliest history. It presents many peculiarities. Its nose terminates abruptly in a vertical line, its nostrils being inserted in the circular end. Its lower jaw is shallow and runs to a point. The eyes are disproportionately small. The forehead rises abruptly. The ears are semi-erect and the neck is almost wanting, the head seeming to be set on the body. The legs are short and terminate in five toes, only two of which touch the ground. The body is covered with bristles at the base of which, close to the body, there is often a growth of short hair. The tail is fleshy, short and curly. The Pig has the general reputation of a dirty animal, but it is only because he is kept in that condition. In fact he prefers to be clean and will keep himself so if he is given the opportunity and the means. He gets his food by rooting with his nose in the earth where he finds the roots of grass and of vegetables. His ordinary voice is a grunt, but when in pain or in fear he utters the shrillest shrieks. His value consists chiefly in the flesh, and, in breeding, the chief care has been to produce the fleshiest varieties. The chief English breeds are the Berkshire, Yorkshire, Cheshire and Essex. The Poland-China originated in the state of Ohio. They are dark spotted or black; small, broad, concave face and drooping ears. The Duroc-Jersey originated in New Jersey so far as is known. They are very large, of a red color and have lopped ears. The greatest hog-producing state in the Union is Iowa. Ohio, Missouri, Kansas, Illinois, Indiana, Kentucky and Nebraska also raise a great many. The annual yield is very nearly 200,000,000. The largest pork-packing establishments are in Chicago, Kansas City, South Omaha, Sioux City and Cincinnati. America is unable to satisfy the foreign demand for the pork products. These are the meat in various forms; the lard or fat; the skin, used in book-binding and in making saddles, foot-ball covers, etc.; the bristles for brushes; and the hoofs for mucilage.



## THE GOAT

MANY varieties of wild Goats are found in the mountainous countries of Europe and Asia. They are sure-footed animals and make long leaps from rock to rock with the greatest ease or certainty. The hunter is often unable to follow them to the dizzy heights where they take refuge from pursuit.

It is not certain from which of the wild breeds the common domestic Goat has come, though the Persian wild Goat, or Asiatic Ibex, appears to be his nearest wild relative.

The Ibex is found in the mountains of central Asia. He is smaller than the true Ibex of Europe but much larger than our common Goat, and has long, curving horns which grow to the length of three or four feet.

The flesh of the Goat is good for food, though its flavor is not so mild as that of beef and lamb. At one time it was the flesh chiefly offered in the markets, so that those who sold meat were called goat-fleshers, that is *buccarius*, whence our word butcher.

The Goat's milk is very rich—much richer than cow's milk. It is considered to be a very healthful food, and for this reason it is often given to young children. The skin of the animal is in great demand for use as leather. Leather made from the skin of the young Goat is very fine in quality and serves many useful purposes; of this the familiar "kid gloves" and "kid boots" are important examples.

In some countries of Europe, the poorer people depend largely upon the milk and flesh of the Goat for food. These creatures, like sheep, can live on scanty herbage, and in the mountains, where cows could not be kept for lack of sufficient feeding-ground. Goats find plenty to eat and repay the peasants well for the care bestowed. Robinson Crusoe had on his island a herd of Goats, by which he was well provided for, as he got from them meat to eat as well as milk to drink and skins for clothing.

The hair of some species is very valuable for weaving into cloth. The long soft hair of the Cashmere Goat is especially prized for making shawls, and the beautiful silky hair of the Angora Goat is used in the manufacture of many fine cloths, and in its natural state is a very pretty ornamental fur.

The horns of the common Goat are flat at the base, often corrugated, rise straight up from the head and curve to the rear. The color of the Goat is white or brown, but never black as that indicates

an Asiatic origin. The head is short and tapering and not ungraceful. The nose is small and the forehead wide and flat. The legs are stout and strong and are often covered with hair. The tail is very short. The chin is usually bearded.

The Maltese Goat is remarkable for its long ears which hang down below the jaw. They are usually harmless.

The Syrian Goat has very long hair and ears. Sometimes the ears are so long that they have to be cut to keep them from becoming entangled in bushes.

The Angora Goat has long hair of a fine silky texture all over its body. The face is much like that of a sheep. The hair is called mohair. The animals are clipped in early spring and yield about two pounds each. The hair is sometimes eight inches long. The Goats are much prized by the Turks and are sold reluctantly and at high prices. The skin of the Angora Goat makes a very fine quality of oriental Morocco leather. When taken from the native climate, the hair of the animal becomes shorter and of coarser quality.

The Cashmere Goat has two coats, the longer, of hair; the shorter, more wool-like. It is the undergrowth that is so valuable and from which Cashmere shawls are woven. It is grayish-white in color, and soft, silky, and fluffy. The wool is obtained by combing in the spring. The manufacture of a shawl takes several weeks' work. At one time 16,000 looms were at work on Cashmere shawls.

## THE DEER

THERE are many kinds of Deer, and they are found in all the continental parts of the northern hemisphere and South America.

They were formerly found in all parts of our own country and are still to be seen even in states as thickly populated as Massachusetts. As the fiercer wild animals have been killed off and driven to the mountains, the Deer has had a better chance for life. In Vermont, where Deer are protected by game laws, they have increased in number and have become so bold that they often leave the woods and feed in the farmers' grain fields, thus doing no little damage to growing crops.

Deer vary in size according to their species. The common kind, which we sometimes call the Virginia Deer, is about as tall as a calf, is very slender and graceful, and has long, delicately formed legs. The Fawn, or young Deer, has a spotted coat, but as he grows older



this changes to a dark solid color, which becomes yellow and white on the underparts. The food of these animals is acorns, nuts, fruits and grass in summer, and the tender buds and twigs of bushes and trees in winter.

The male Deer or buck has horns called antlers, which vary greatly in size and shape among the different species. In the common Deer they are from one to two feet in length, and have many branches or prongs growing from the main horn. All Deer shed their antlers once a year, and new ones grow out to take the places of those cast off.

When frightened, the shy creature darts away at great speed, and will run for miles through the forest with his head thrown back. But when followed by dogs for a considerable time he is often overtaken and brought to bay. He makes a brave fight, however, and strikes at the dogs with his hoofs and antlers, often injuring or killing some of them. It sometimes happens that a wounded buck, maddened by pain, will turn on the hunter, and unless the hunter can find refuge behind some friendly tree, he may be roughly used, or even killed.

Deer are sometimes hunted by stalking, as in the highlands of Scotland, where the country is too rough for horses. The hunter follows noiselessly on the animal's track, and is often forced to crawl a long distance in order to get within gunshot, for Deer are suspicious creatures, and while feeding often raise their heads and look about to see if an enemy is near. They are also very keen of scent, and if the wind blow from the direction of the hunter, the animal detects the presence of a human being, even though the two are a long distance apart, and instantly takes flight.

Deer are good swimmers and often swim across a pond or lake two or three miles in width. They like water and go frequently to near-by streams to drink. They are also very fond of salt and need it occasionally as a tonic.

These animals may be tamed, and their fear of man may be so far overcome that they will eat from his hand and come running to the gate of their inclosure when they see some one approaching, in the hope of getting a piece of sugar or some other dainty. But they start in fright at the least threatening motion. They never become friendly with dogs, which are as eager to follow and worry Deer as they are fond of chasing eats.

The Moose is the largest of the Deer family. He commonly stands over six feet in height at the shoulder, and his enormous antlers occasionally weigh as much as fifty pounds, and spread to a width of six feet. This noble animal is found only in the colder climates,

rarely farther south than Maine and Canada. In early winter his coat is black, and later in the season it turns to gray. Unlike other Deer, he feeds principally on leaves and shoots of trees.

He is a long-legged animal and can travel easily through one or two feet of snow, but when it becomes deeper than that, several Moose join with each other and form what is called a "yard." This is a place in the deepest part of the forest, where the animals tramp down the snow for a considerable space until it is hard. A wall of untrodden snow is thus left to form the sides of the yard, but is also found at many places inside the yard. They also make narrow paths to other places in the forest, where they go to feed. Moose spend the entire winter in these yards, and, with a solid floor under their feet, do not fear the wolves which often come to attack them. The Moose can fight nobly with his hoofs and antlers, and, when wounded, will attack a man and trample him to death, if he is unable to escape.

The Wapiti, or American Elk as he is called, is another large Deer which formerly was found throughout this country, but has now been driven to the far western states. He is a magnificent creature, much larger than the common Deer. His branching antlers spread to a width of four or five feet. They are more graceful than those of the Moose, and give his head a noble appearance.

The Caribou is another large Deer with immense antlers. He is found in Canada and in the forests of Maine. The Caribou has a greater advantage over the hunter than the Moose has, in that he is able to run swiftly over the snow. The Moose sinks deep in the snow at every step and is soon overtaken, but the Caribou has large hoofs that spread apart, and limber hind legs that help to bear his weight, just as the rabbit is supported by the lower half of his hind legs. This enables the Caribou to travel with little difficulty over the snow, as well as across swamps that a Moose could not pass.

The Reindeer is a species of Deer that man is able to tame and apply to his own uses. He is closely related to the Caribou, and is found only in very cold countries, like Norway, Lapland and Siberia. Like other members of the Deer family, he feeds on grass, leaves and twigs, but he also eats moss and sea-weed. In winter he scrapes away the snow that covers the ground and feeds on the moss and lichens that he finds underneath. The Reindeer is as valuable to the Laplander as the camel is to the Arabs, or as the horse and the cow are to us. Both the flesh and the milk of the animal are used for food, and his skin is used for making clothing and harness. The Eskimo also use it for covering their tents. When harnessed to a sledge, the Reindeer can travel over the snow very swiftly, and he is



able to maintain for many hours a speed equaling that of a horse. The Reindeer has a thick, rough coat and endures the severest cold without hardship.

In Asia is found a pretty little Deer, no larger than a goat, which is called the Musk Deer. He has no horns, and looks very like the females of other members of the Deer family, except that he has two long tusks sticking down like those of a walrus in miniature. The Musk Deer is provided with glands from which we obtain the perfume called Musk.

The flesh of the Deer, called venison, is much sought after for use on the home table, as well as in the hunter's camp. The tanned skin makes a fine, soft leather, which is used for many purposes by the Indians. They make from it moccasins, leggings and jackets, which the Indian women ornament with bead-work. When Morgan's famous riflemen went from Virginia to join the Continental army at Cambridge, in 1775, their only uniform was a deer-skin suit.

The antlers of the deer are not smooth, like the horns of a cow, but have a rough surface. They are very hard and are much used in making knife-handles and other useful articles.

## ANTELOPES

THE Antelopes are neither goats, sheep, nor oxen, although they have characteristics of all the three; yet are more beautifully formed and more graceful in their movements than any one of these. In their swiftness and gracefulness, some of the Antelopes are like deer. They are the most timid of all animals, and are able to run very swiftly, so that they can escape from any of their foes, unless they approach by stealth and surprise them. The true Antelopes resemble the goat, in that they have long, slender horns, which are sometimes straight, and at other times curved in graceful lines, but never branching like the antlers of a deer. They have slender legs, with small hoofs and a slender body.

There are many species of Antelopes, having different names. Many are found on the wide, open plains of South Africa. The Eland is the largest of the African Antelopes. He is larger than a cow, while others again are no larger than a hare.

The Antelope known as the Chamois, from which the familiar chamois skin is obtained, is a native of the mountains of Europe. He displays wonderful agility in climbing over the rocks in the most dangerous places.

In different parts of Asia, Europe and Africa, other kinds of Antelopes are found, and in our own country we have the Pronghorn Antelope and the Rocky Mountain Goat, which belong to the same family. The Pronghorn Antelope has been so steadily hunted that he has almost disappeared from the United States, but the Rocky Mountain Goat, is still found among the snow-crowned ranges of Idaho, Montana, British Columbia, Alaska and other parts of the far Northwest.

One of the characteristics of the Pronghorned Antelope of America is great curiosity, and it is this which often makes him a prey to the hunter, when, by the use of his fleet legs, he might easily escape. A man lying face down in the grass and waving his heels in the air will attract the attention and excite the curiosity of these timid creatures, so that in order to see what those waving legs mean, they will approach within gunshot.

In Africa, the natives sometimes cover their bodies with the skin of the ostrich, and thus are able to approach near enough to the herd of Antelopes, to shoot one or more of the animals before the herd takes alarm. Antelopes eat grass and tender shoots of trees. They keep as far from civilization as they can, and soon die if held in captivity, without opportunity to run about freely.

All of these beautiful creatures fear man, and well they may, for he has hunted them with so little mercy that many species which were common at one time are nearly extinct. While their skins have some value, and their flesh is good for food, thousands have been shot solely because the hunter wanted their heads and horns to mount as ornaments for his home or clubroom. Even in Africa the splendid Waterbuck and Sable Antelope are becoming rarer year by year, and it is probable that in a few years they will have entirely ceased to exist.

## THE ROCKY MOUNTAIN SHEEP

THE Rocky Mountain, or Bighorn, as he is often called, is, as his name indicates, one of the largest of American wild animals.

His home is in the Rocky Mountain region of British Columbia and the United States. Before every train carried to the West hunters armed with high-power rifles, he was to be found in great numbers throughout the hilly and mountainous regions beyond the Missouri River.

The size and stateliness of the animal command the admiration of all who see him. He has a head like that of a sheep, with huge, curving horns which sometimes reach a length of four feet, and measure



seventeen and a half inches around the base. His body is larger than that of the common deer, since he averages about six feet in length, and three and a half feet in height at the shoulder. He weighs from three hundred to three hundred and fifty pounds. He has a stubby, upturned tail, about two inches in length. A fine wool grows close to the skin of the Bighorn, and he has an outer coat of hair like that of the deer. This hair is short in summer, and becomes long, thick and rough in winter.

The Mountain Sheep is very shy, and seldom permits a hunter to approach within shooting distance. He climbs the steepest mountains, and bounds gracefully and easily over chasms and boulders, alighting safely on narrow ledges of rock. He will stand for hours on some mountain peak and watch the movements of men or animals far below. All sheep, even our domestic variety, like a hilly country, but the rougher and more mountainous his home is, the better is the Bighorn pleased with it. The animal descends to the valleys early in the morning, to feed on the tender grass. In the middle of the day he returns to the mountains, and again descends at sunset to continue feeding.

There was formerly a superstition, which is no longer credited by sensible people, to the effect that the Bighorn could leap from great heights, and by alighting on his horns, rebound, and regain his feet without injury. The belief in this idea was probably based on the fact that the Bighorn takes long leaps and that his great horns are often found to be badly splintered. We know, however, that this is the result of his battles with other Mountain Sheep, for he is brave and determined, and even man finds him a dangerous antagonist in a close encounter. With his great horns, he can knock down an enemy, or hurl him over a precipice.

The flesh of the Mountain Sheep is said to be the most delicious meat obtained from any animal in the West; but the hunter may creep from crag to crag for hours, without being able to obtain even a shot at this sure-footed and agile creature, so that it is but seldom his flesh goes to form a part of the camp dinner.

## THE AMERICAN FOX

“**S**LY REYNARD!” we call him; and hundreds of stories and poems have been written, and hundreds of paintings made, which have for their subject this crafty little fellow, who is one of the best known of the wild animals. He is a member of the dog family, and you will see that his head is much like that of the dog,





FROM COL. MR. F. KAEMPFER.

MOUNTAIN SHEEP.  
1/10 Life-size.

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From col. Mr. F. Kaempfer

AMERICAN RED FOX.  
1/6 Life-size.

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although his snout is longer and more pointed. His sharp teeth are like the dog's, and he seizes his prey in the same way.

There are many varieties of Foxes. The Red Fox is the European kind. The American Red Fox is found in the northern states and in Canada. In the South the Gray Fox takes his place. Then there is in the West a tiny animal called the Kit Fox, whose fur is gray on the back, yellow at the sides, and white underneath. The Red and the Gray Foxes are the only ones hunted in this country.

The Fox's tail is his chief ornament, and hunters prize it as a trophy of the chase. It is long and bushy, so much so that it sometimes sweeps the ground as he walks, and it serves him as a rudder when he is jumping or running swiftly.

Time and money are lavishly spent in breeding horses whose chief use is to carry the hunter over the fields and hedges, in pursuit of the nimble Fox; and for every Fox to be found in the more thickly populated parts of the country, there are at least two dogs that have been bred and trained for the sole purpose of following his scent and running him down.

A few people have attempted to make us believe that the Fox is not so cunning as he has been believed to be, but they must be grumblers who dislike to see the deserving get credit for cleverness. Very often the Fox is clever enough to escape from the hunter and dogs, although sometimes he is killed after a hard run for his life.

In the South, the hunters ride on horseback after the hounds. Foxes follow the same paths in going about the country and these paths are called "runways." In some parts of the North the hunter looses his Fox-hounds, and taking his station near a runway where he expects the Fox to pass, waits until the dogs shall drive the quarry past him, when he shoots him down, but in Europe it is considered a shameful thing to shoot a Fox.

The animal exhales a strong odor, which often lies for an hour or more upon the ground over which he has passed, and along this trail of scent the keen-nosed hounds will follow for hours. When dogs are after him, the Fox has an opportunity to show his cunning, for he knows very quickly, when he hears the yelp of his pursuers, that he is being hunted. Sometimes he runs to the top of a hill, and then, leaping over a bush on the summit, turns quickly on his own trail and runs back in the direction from which he came. The eager dogs follow the trail to the bush, leap over and go pell-mell down the farther side of the hill. Not until they have nosed about for some time do they understand that they have lost the scent and must go back to the bush to find it. Meanwhile the Fox, running at full speed, has gained a start, and may be able to get away safely and



baffle the dogs in their pursuit. Foxes know that their strong odor gives the dogs their scent, and when pursued they will sometimes run to a heap of manure and roll about in it, so that when they start off again, the scent of the animal is lost and the dogs do not know which way to go. Another of Reynard's tricks is to run along by a wall and then, leaping upon it, trot along the top for some distance before he returns to the ground. This also baffles the dogs and may give the Fox a chance to get away from them.

He is very suspicious of all kinds of traps, and will often pass by the most tempting bait, when he suspects that a snare is concealed beneath it. If caught in a steel trap, however, he will twist and gnaw off the imprisoned leg and make his escape on the other three rather than remain and be captured. The fur of the Fox is fine and soft and that of the Silver Fox, which is a variety of the ordinary Fox, is especially valuable. Reynard's flesh is not good for food.

The Fox makes his home in a burrow in the ground. He does not always take the trouble to dig a hole for himself, but uses the abandoned den of a badger, or woodchuck. Reynard is seldom seen out of cover in the daytime, unless driven forth by dogs, but at night he goes in search of food.

He eats rabbits, mice, birds, eggs and other good things. He is fond of fish, and catches them very cleverly by waiting patiently beside a stream until a plump trout shows himself in the water, when, with a quick leap, he snaps up the fish and carries it away to feast on at his leisure. He hunts birds, too, and many a plump quail or partridge becomes his prey. He catches rabbits and even attacks young lambs. His fondness for poultry and eggs earns for him the cordial dislike of the farmer. No matter how securely the hens and ducks may be shut up in the poultry yard, Reynard will, if necessary, burrow under the fence and seize upon a chicken or duckling, with which he hurries away in triumph. As he likes fish, flesh and fruit, he shows that he appreciates most of the good things that we ourselves eat.

## BEARS

**B**EARS of one sort or another are found in wild or thinly-settled countries throughout the continental part of the northern hemisphere. They make their homes in the hot countries of the equator, the regions of the temperate zone, and even within the arctic circle. There are many different kinds, however.

The most ferocious and most dreaded Bear in the world is the Grizzly, which is found in the Rocky Mountains. No animal of the

western hemisphere compares with him in strength and ferocity. The Grizzly has a long, tapering snout and small, evil-looking eyes which give him an unpleasant appearance. He has a heavy, slouching gait, and does not look as if he could move very swiftly; he can, however, run with remarkable speed.

The Grizzly is the only bear that will always attack a human being at sight. Many a man who has gone out to hunt the Grizzly Bear has had the tables turned and found that the bear was hunting him.

With his powerful forepaws, which are armed with long, sharp claws, the Grizzly can tear a man's scalp loose at one blow, and his vicious bite inflicts a terrible wound. When infuriated by wounds, the Grizzly becomes a terrible antagonist. Even though struck by bullets and torn by dogs at every step, he will rush upon the hunter, in a last desperate effort to strike one crushing blow at his enemy, and oftentimes he is able to close in upon him so that the latter cannot use his rifle, but must depend upon his knife to kill the animal before the Grizzly kills him.

Like other bears, the Grizzly is fond of honey, berries and grain; but he also eats young animals and fish, and will kill and feast upon a cow or a horse. The mere track of the Grizzly Bear in the soil is a sufficient warning to other animals to beware. Not only the timid deer, the elk, the fox and the wolf, but even the mountain lion and the wildcat fear the terrible Grizzly and avoid him at all times. As the lion is king of the desert, so the Grizzly Bear is monarch of the mountains, for only man is bold enough to attack him.

The Indians esteem it a strong proof of a man's courage that he has killed a Grizzly Bear, and they make necklaces of the bear's claws, which they wear about their necks and which they exhibit with pride as a proof of their bravery.

The Black Bear is the variety most common in the United States, and while still found occasionally in Maine and northern New Hampshire, is more often seen in the sparsely settled mountainous sections of the West. He is a powerful animal, but, unlike the Grizzly, he seeks no quarrel with man, and unless pursued and wounded, or famishing with hunger, he is not disposed to attack human beings.

He has a great liking for blueberries and for honey, and will climb trees and be at great pains in order to rob a bees' nest. He is a daring thief, and will come down from his den on the mountain to steal a young pig or a lamb from the farmer. A bear cub can be brought up to be quite tame, and may be taught to do many tricks.

The Polar Bear, whose home is in the regions of ice and snow, is a large animal which often measures ten or eleven feet in length and



weighs nine hundred or a thousand pounds. His principal food is the flesh of the seal or the walrus, which he attacks and kills, and fish, which he is expert in catching. The Polar Bear moves very swiftly over the snow and ice, and his white coat makes it possible for him to lie in wait for his prey, or approach near to it, without being noticed. He will fight like other bears, when compelled to do so, but if unmolested will not, unless very hungry, attack a man.

In other countries, we find different species of bears, but all have certain characteristics in common. They live in dens or caves, to which they retire during the winter season, if there is one, and remain there asleep, or in a torpid condition, until the warmth of the spring brings them forth again, very hungry and eager for prey.

Some boys in Maine who were going across lots, one winter afternoon, were overtaken by a snowstorm and compelled to seek shelter. They managed after a time to find their way to an old barn or shed which afforded them some protection from the storm, and as it gradually increased in violence, it became evident that they would have to spend the night there. The wind blew the snow in upon them, and they suffered greatly from the cold until one of the boys suggested that they loosen a board in the floor and seek shelter under the barn, where the wind could not reach them. This they did and soon were snugly housed. It was dark under the barn floor, but they did not mind that. They noticed a strong animal odor in their new quarters, and one of the boys, moving a few feet away from his companions, found himself resting upon a huge bundle of fur. The fur proved to be the coat of a large bear which was having his winter sleep under the barn. Roused from his torpid condition, the bear stirred and growled and the boys lost no time in climbing back to the upper side of the barn floor, where they remained shivering until daybreak. When morning came they made their way home. After getting warmed and having breakfast, they returned to the barn with their guns and drove the animal from his refuge. The boys secured a fine bearskin, and thought themselves fortunate indeed to have escaped so well.

The bones in the bear's hind legs are shaped much like those of a man's leg, and this enables him to stand erect and look about him more easily than when he is on all-fours. When attacked at close quarters, he raises himself on his hind legs. The dogs rush up to tear him, but he crushes them in his powerful embrace, and if the hunter comes within reach the bear gives him a hug that may easily break the man's ribs.

The bear is remarkable for his "sweet-tooth;" and besides honey, which he takes so much pains to get, he is fond of candy, cakes and

other confections. The animal's skin is valuable, and makes a warm robe for use in winter, as the long thick fur gives excellent protection against the cold. Bear's grease, which is obtained from the fat of the animal, is used as a dressing for the hair.

## THE AMERICAN BISON

A DARK line on the edge of the prairie, growing wider from moment to moment; then a confused mass of moving objects; a cloud of dust; the confused mass comes nearer; now it is distinctly seen to be a great number of animals; a multitude of shaggy heads and waving tails; countless powerful beasts rushing on at great speed, and trampling under foot all that lies in their path;—what is all this? It is a stampede of American Bison!

Such a scene was common on the great prairies of the West twenty-five years ago; to-day we know what it was like only from the stories of old hunters who saw the Bison in his glory; for no such mighty herd sweeps across the prairie to-day or ever will again.

The American Bison, so often miscalled the buffalo, was the most magnificent feature of distinctively American animal life. He belonged exclusively to us as much as do Niagara Falls and the Mammoth Cave, which are wonderful things, to be seen only in America, but we hunted and exterminated him for the sake of gain, and now that we want him for the sake of nature, he is gone, and cannot be replaced.

The pioneers who first crossed the prairies of the middle West found the vast herd of Bison feeding upon the rich grass of the Mississippi Valley. They were amazed at the number of these animals, the like of which they never had seen before. For many years he furnished them with food and gave his skin to protect them from the weather. The native Indians had known him for generations—they could not remember when the Bison had not been with them.

Until thirty years ago, these animals continued to herd in vast numbers on the western prairies, moving farther westward year by year as the country became more thickly settled, and when the Union Pacific Railway was built across the continent, they divided into groups. The value of the Bison's skin had become known, and the railroad carried to the prairies hundreds of hunters who slaughtered the animal in great numbers, in order to obtain the skins which were sold in the East. Thus pursued by the hunter, the Bison fled from the vicinity of the railway, some turning northward, toward



Canada, and others moving to the south. In the three years, from 1873 to 1876, these animals were slaughtered in such numbers that hundreds of thousands of skins were taken.

By 1880 the Bison had become scarce, and to-day it is almost impossible to find them in freedom; no large herd exists anywhere on the face of the earth. A few Bison made their way into the Yellowstone National Park, in Wyoming, and there the government protects them; some were found until lately in Texas and in the wild spots among the Rocky Mountain ranges. A few are supposed to exist in other places, but as a conspicuous feature of natural wild life they have disappeared forever.

If you have an opportunity to see Bison in some zoölogical park, by all means do so, and study these wonderful creatures, for there is reason to fear that within the lifetime of persons now living the last one may be lost to us.

The Bison is not a buffalo, and should never be called by that name, for the buffalo has legs of equal length, long-curving horns and a coat but thinly covered with hair, while our American Bison has high foreshoulders, causing his back to slope to the rear, a shaggy mane covering the head and forequarters of his body, and short, round, up-curving horns. Moreover, the wild buffalo is not found in this country.

The Bison is a grass-eating animal and "chews his cud" like our domestic cattle. He was accustomed to follow the streams, preferring a well-watered country, and one of his amusements was "wallowing." A "buffalo wallow," as old hunters describe it, was the Bison's bathtub. The animal selected a shallow depression in the soil, where an inch or two of water had collected, and then, lying in the pool, rolled from side to side, digging up the earth with his horns and hoofs, and bellowing with delight. This rolling, or wallowing, would be continued for hours at a time, until the soil had absorbed all the water in the pool, and a bed of thin mud was formed. When the Bison emerged from the "wallow," his shaggy coat would be plastered with mud, which the sun soon dried. It is possible that the animal not only enjoyed his wallow, but found in the coat of mud an excellent protection against the stings of flies and other insects. Bull Bison would sometimes fight for the possession of an inviting wallow, the victor claiming it as his special property for the time being.

Before white men brought them the deadly rifle, the Indians killed the Bison with the bow and arrow. When a herd of Bison was sighted, the Indians, who hunted in bands, would separate and surround the herd. Then closing in on the frightened animals, they would circle about the herd on their swift Indian ponies, driving

their arrows into the Bison, up to the feather. They continued the slaughter until the entire herd was killed, except for a few animals that might be able to break through the line of horsemen and flee over the prairie. The meat thus obtained provided an entire Indian village with food for several days, and the skins were tanned and used as coverings for the tents, or tepees, in which the Indians lived, as well as for many other useful purposes, such as the making of lariats, or lassos, saddles and bridles for their horses, quivers in which to hold their arrows and buckets in which to carry water.

The white man did not need the Bison for food, but he quickly learned the value of the skin, which is very strong and durable. Bison or "buffalo" robes were very common throughout the country at one time, for when the general slaughter of the herds began, the great number of skins put upon the market made the price comparatively low, and even the poor man who needed a robe for his sleigh in winter could afford to own two or three Bison skins. Many of those who read this will remember sleigh-rides that were made more enjoyable because the riders were snugly tucked in under shaggy "buffalo robes." These skins were also made into coats which furnished almost as good protection against the cold as a bearskin.

The color of the Bison ranges from a dull yellow to black. It is always black on the head, and a great herd of Bison presented a picture of thousands of black heads, above which could be seen the brown backs, and also the short tails which the animals from time to time waved in the air. When he runs or charges on an enemy, the Bison lowers his great head.

On the plains, the Bison attended strictly to his own affairs and a herd would move past a camp, grazing within a few feet of men and horses without offering to molest either, if no offense was given them. Once wounded, however, the Bison became a dangerous creature. Bellowing with rage, his tail held up like a danger flag and his head lowered, he would rush upon the hunter, whose only safety lay in escape through the intelligence and speed of his horse. Awkward as he looks, the Bison can run rapidly for a considerable distance. To shoot at his head is useless, for the great thickness of the skull causes the bullet to glance off as from a rock. If the hunter is on foot, he must wait till the animal comes near, and then dodge and run for any shelter that offers. The Bison's eyes are so placed that, with his head lowered for a charge, he cannot see objects in front well enough to alter his course quickly. This defect in sight has saved the life of many a hunter, who had been thrown from his horse and was "charged" by an angry Bison before he could recover the rifle he had dropped.



The Bison moved from place to place, seeking feeding-ground where the grass was richest, and thus roamed over hundreds of miles of fertile country. His home was the whole wide sweep of prairie. Now, where he once fed on the tender grass, cattle range over the prairie, or the rich soil is under cultivation and produces millions of bushels of corn and wheat.

The opening up of the western country has brought us large gain, but every American must feel a sense of loss in the disappearance from the face of nature of our noblest wild animal.

### THE TRUE BUFFALOES

THE true Buffaloes are best described as wild oxen, and their habits are much the same as those of ordinary cattle. They eat grass and tender plants and "chew the cud." The best known of the buffaloes are found in Southern Europe and Asia to-day.

Near relatives of this animal are natives of India and Africa. Their horns are long and pointed, and in the Cape Buffalo, the spread of the horns measures three feet. In the true or Indian Buffalo, the horns have a spread of four to five feet.

The Cape Buffalo is as large as the domestic ox, and an even more powerful animal. When wounded, he will turn and defend himself, and in doing this he shows no little cunning. While the hunter is following a wounded buffalo through the tall grass, the animal will sometimes go back and take a position near the track which the hunter is following, and then, without warning, charge upon him with great ferocity.

In the Philippine Islands, there is a small species of this animal called the Water Buffalo, which is domesticated by the natives and used for drawing carts.

### THE COTTONTAIL, OR AMERICAN RABBIT

JUST look at Snap, the terrier! Why is he so excitedly digging away the earth from that opening in the ground?

Snap has discovered a Rabbit's burrow, and if we give him time he will make the hole large enough to enter and will go in pursuit of Bre'r Rabbit. But instead of letting him do that, we will call him away, and perhaps Bre'r Rabbit will come out and give an account of himself.

The Cottontail Rabbit is a very timid creature. His long ears enable him to hear the least sound very distinctly, and the dropping

of a leaf, or the slightest rustle in the bushes, will startle him. When he is frightened, he makes no noise, but remains perfectly still, or raises one little paw before starting away on a hasty run to a safer part of the woods.

The European Rabbit burrows in the ground and makes his nest at the end of a long tunnel. Where a number of Rabbit families have their burrows near each other, with connecting passages under-ground, we call the place a rabbit-warren. But our common Rabbit is the Cottontail. It is quite different and never forms warrens.

Wild Rabbits usually have a gray or brown coat, which is less conspicuous than the white or black fur that some of our tame Rabbits have. This coat, being so nearly like the ground and the leaves in color, enables the animal to move about without being so readily seen by his enemies. The Rabbit has long hind legs, or rather, he has very long hind feet. It is on these latter that he rests when he sits up and looks at us so sharply, wondering if any harm is coming to him. A lover of nature thus writes:

"We were riding through the woods, down in Virginia, one summer day, the horses walking slowly along the dusty road, when close by we saw a little brown Rabbit or Cottontail sitting up and watching very intently. We expected to see him dash away through the bushes, but perhaps he had never seen horses or people before, and so was not afraid. At any rate, he allowed us to pass very close to him, keeping his long ears pricked up and his head turned a little to one side, as if he were saying to himself, 'What strange giants are these?' We kept very quiet, so that he might not be frightened. But Master Roger, spying him, clapped his hands and cried out, 'Oh, Brown Bunny! Papa! there's Brown Bunny who ran away from Mr Wolf!' Even then the little brown Rabbit did not stir, and looking back when we had gone beyond him, we could see that he was still sitting by the roadside, wondering who those people in the carriage were. We thought he was the bravest Rabbit we had ever seen, but perhaps he was a very young Bunny, who had run away from home and had not yet learned to be afraid."

Nature has made the Rabbit a gnawing animal, like the squirrel. He has six front teeth, four in the upper jaw, of which only two show in front, and two in the lower. These teeth are very long, and are as sharp as knives. Their edges are formed like the edge of a chisel, and as fast as these edges are worn away by constant gnawing, the teeth grow out from the jaw, so that they are kept at the proper length all the time. In order that he may use his gnawing teeth to better advantage, the Rabbit's upper lip is divided at the



center, so that it may not be in the way when the Rabbit wishes to gnaw anything, such as the bark of a tree.

It is with these sharp gnawing teeth that he does so much damage to young shade and fruit trees. A Rabbit enjoys sharpening his teeth upon a tree and sometimes strips the bark from young trees as high as he can reach all the way around the trunk. The Rabbit often does this when his other kinds of food are hid in the snow. He is not satisfied to do this with one or two trees, but will chisel the bark from a dozen or fifteen trees in a single night. Sometimes he eats the bark, but at other times he seems to strip it off simply because he enjoys the exercise, and likes to get a fine edge on his teeth. The owner of the trees does not enjoy this so much as the Rabbit does, especially if they are valuable young fruit trees.

Cabbages, lettuce, carrots and other green vegetables are favorite food with the Rabbit, though he eats grain too, and often does much mischief to the farmer's crops. The Rabbit has many enemies, such as the weasel and the mink, which make their way into his burrow, and give him a fatal bite. Then there are eagles and large hawks, which pounce upon him and carry him off to their nests.

He has no means of defending himself, so must depend for protection upon his cunning in hiding or upon his fleet foot to carry him out of reach of danger. The natural provision for his safety is that he sleeps with his eyes open, and his enemies cannot take him unawares. The Rabbit has a keen sense of smell. You must have noticed how his little brown nose is constantly sniffing at everything about him, and he also has "whiskers," which help him to find his way underground or in the dark.

The European Rabbit, from which our tame Rabbits come is noted for the rapidity with which it multiplies. In Australia, where it was introduced some years ago, the species became such a pest that the government offered rewards to persons who would suggest the best means of getting rid of them, for extensive crops were being destroyed and the farmers were in danger of being impoverished. Just as he girdles trees for the sake of sharpening his teeth, or for amusement, the Rabbit will bite into and destroy hundreds of growing plants which he cannot eat; and he is so mischievous in this way that the farmers in Australia are compelled to hunt and kill Bre'r Rabbit without mercy.

Tame Rabbits are gentle creatures and their coats are often very handsome, some being black and white and others all black or all white. The proper way to lift a Rabbit is by his long ears, which are very strong, and at the same time he should be supported underneath with one hand. To make up for having such long ears,





From col. Chi. Acad. Sciences.

GRAY RABBIT.  
 $\frac{1}{2}$  Life-size.

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the Rabbit has only a stub of a tail. In our wild Rabbits these tails are covered below with white, fluffy fur, from which they get the nickname Cottontail.

The Rabbit is sold in great numbers for food, and excellent food it is. Many people make their living by hunting wild Rabbits, which they sell in market, and others do even better by carrying on Rabbit-farms, where they raise the tame or European Rabbit as a farmer raises pigs. Rabbit-skins are sometimes used, in place of the more expensive skins of other animals, in making fur goods, and the hair of the animal is also used in making felt. There is a species of these animals called the Angora Rabbit, which has long hair like the Angora cat, and this is combed from the animal and sold for wool.

### THE AMERICAN OR NORTHERN HARE

THE Northern Hare is at first sight much like the Cottontail Rabbit. But there are several points of difference between them.

The Hare is larger than the Rabbit, and does not burrow in the ground as the latter does, but makes his home in a "form" as it is called—a snug nest of leaves and twigs, which rests on the ground in some spot where it is surrounded by bushes.

The hind legs of the Hare are even longer and stronger than those of the Rabbit and he is able to take long jumps with the greatest ease. But a most important difference is that the Hare turns white in winter and the Rabbit does not.

The Prairie Hare, which we have in the northwestern part of the United States, is called a Jack-rabbit. He is a large and strong fellow, weighing several pounds, and is a famous jumper. When startled he throws up his long ears and bounds through the air at such speed that dogs seldom overtake him.

In cold countries the Jack-rabbit's coat also changes from brown in summer to white in winter, so that it is not conspicuous when seen against the brown earth or the snow, according to the season.

There seems to be something about the Jack-rabbit that excites laughter, for travelers and hunters tell many a humorous tale about the animal. Perhaps it is because his long ears give him a donkey-like appearance, or because the kick of his powerful hind legs is like that of a mule. His great alarm when he is suddenly disturbed, and the astonishing speed at which he makes off, are somewhat amusing.

Mark Twain has written a humorous description of a Jack-rabbit that he started up, in which he says: "He frequently dropped his ears, set up his tail and left for San Francisco at lightning speed.



Long after he was out of sight we could hear him whiz." This is a case of stretching the truth, of course, but it gives an idea of the Jack-rabbit's speed. The flesh of most Hares makes good eating, that of the tame or Belgian Hare being especially fine. The skin is tanned and used for some purposes as leather. In America we have many different kinds of Hare. The subject of the illustration is the northern Hare in its white or winter dress.

## THE WOODCHUCK

ONE of the most familiar of the digging animals, or burrowers, is the Woodchuck, or Ground-hog

He is found throughout the greater part of the Eastern United States and is especially common in the New England States, where he is almost always called a Woodchuck.

The Ground-hog is about eighteen inches long and has a bushy tail that adds four inches more to his length. His fur is of a grizzly color, except on the under parts of his body, where it changes to reddish brown, while his head, tail and feet are covered with hair of a darker color. He lives in woods, fields and meadows, and digs a burrow in which to spend the winter. In the woods he usually selects the slope of a hill for his home, and digs the hole at the foot of a tree or under a rock. He curves the tunnel downward for perhaps ten feet, and then gives it an upward slope. At the end he makes a comfortable chamber, which he lines with soft grass and leaves, and rarely ventures very far from the shelter of his underground home.

He comes out both by day and by night and feeds on grass, weeds, pumpkins, corn, roots and vegetables, often earning the strong ill-will of the farmer by burrowing in the fields and damaging the crops with his sharp teeth. The Ground-hog is a clumsy looking creature, and moves over the ground in an awkward fashion. He is naturally shy, but if cornered and compelled to fight, he will defend himself bravely, using his sharp teeth to good advantage.

When the farmer or his boys discover a Woodchuck's hole, they at once set about capturing the animal. Sometimes the dog begins to dig him out, and the boys bring spades and help in the hunt. At other times, water is poured into the holes to drown the animal, or a turtle is caught and to its tail is fastened a wire on which is tied a wick saturated with oil. This is lighted, and the turtle is placed in the Woodchuck's hole. The turtle tries to run away from the fire and so carries the torch to the end of the burrow, when the

Woodchuck, equally anxious to escape the flames, leaves his retreat and dashes out, only to be caught by the men or the dogs.

The Woodchuck takes a long winter nap, like the bear. In the North, he sometimes retires to his burrow as early as the first of October. He sleeps for five months and reappears in March. Farther south, where the winter is shorter, he does not sleep so long, and is likely to leave his hole in February, to see if warm weather is really coming. This gave rise long ago to an interesting superstition, with which most of our boys and girls are familiar. It is said that each year, on Candlemas Day, which is the second day of February, the Ground-hog leaves his burrow to foretell the weather. If the day be warm and cloudy, so that the sun is obscured, he decides that spring is at hand and that he must remain awake; in this event there will be an early spring. But if the Ground-hog, on emerging from his hole, finds the air clear, and the sun shining brightly, he catches sight of his shadow on the ground and it frightens him back to his burrow, where he will go to sleep again; and this is a sign that the coming of spring will be delayed for several weeks, and that there will be cold and stormy weather before the Ground-hog ventures from his hole to stay.

It is possible to tame this animal and make a pet of him. He will sit up on his haunches, like a dog, and will beg for sugar, jump through a hoop, or even submit to be harnessed to a toy wagon. The skin of the animal is loose and very strong, but has no great value. It is used to some extent in making whip-lashes. The flesh is sometimes eaten, and by many people is thought to have an excellent flavor.

## THE LEAST WEASEL

THE Least Weasel has a bad reputation, for he is a notorious chicken killer, but he is an interesting little animal, in spite of that.

There is in our country no smaller animal which may be called a beast of prey. The Weasel is but seven or eight inches long and very slender. His head and neck are of about the same diameter as his body, and as his legs are short, he can enter very small holes and kill the animals that live in them, without finding himself in too close quarters. He catches rats and mice, rabbits, squirrels, moles, fish, snakes and lizards; and other small animals which burrow in the ground like himself find him a dangerous enemy.

The Weasel is detested by the farmer, whose poultry yard is a favorite hunting-ground for the tiny animal. He has been known to kill thirty or forty chickens in a single night, doing far more damage



in this way than a fox or a mink would do. He will suck the contents of an egg quickly and neatly, through a small hole which he makes in the shell. His sharp teeth enable him to bite a chicken's neck in two with ease, and, when attacked, is ever ready to use his teeth on dogs or men. He is not disposed to run away when he hears other creatures coming toward him, but raises himself on his hind legs, and looks sharply about to see who is approaching.

The Weasel makes his home in wood-piles, walls, or heaps of stone, or in burrows. He goes about both day and night, and is so small that he is not likely to attract attention, even in the daytime.

Weasels have been used to prey upon rabbits, where the latter had become so numerous as to be a pest, but they killed not only the rabbits, but many game-birds and poultry, as well, and were so blood-thirsty that the results of using them as hunting animals were not entirely satisfactory.

## THE COMMON MOLE OF EASTERN AMERICA

OF ALL the animals that dig holes in the earth in which to make their homes, the Mole is the greatest burrower. The little creature spends his life in the darkness underground, yet he is a very active animal and works almost unceasingly.

There is a popular impression that the Mole is blind, but this is not the case, for he has tiny eyes not much larger than pin-heads, which are so hidden in his fur that they are difficult to find. His senses of smell and hearing are well developed, so that he is enabled to find his food without the use of his weak eyes.

The Mole does not merely dig a tunnel in the earth and make a nest of it, like the otter or the weasel, but constructs an elaborate series of underground passages, which lead to a large central chamber. As he digs these tunnels he throws the loose soil up through a shaft to the earth outside, forming at irregular intervals the little heaps we call "Mole-heaps." By the constant pressure of his body, the earth in the tunnels and in the chamber is made hard and smooth, so that even after a heavy storm it will not cave in. But the weight of a horse or other heavy animal is sufficient to make the crust of earth over the burrows to give way, and this causes the farmer some annoyance in plowing and planting.

The Mole's body is shaped something like that of a pig. His head, which ends in a pointed snout, is apparently not divided from the body by a distinct neck, and this, together with his seeming lack of eyes, gives him a peculiar appearance. He pierces the earth with

his pointed snout and then tears it away with his fore feet, which are large and strong, and are armed with claws especially suited for this use. His progress in digging is very rapid, and he makes his way through sand almost as fast as a fish does through water.

The food of the Mole consists of worms and insects which he finds in the course of his burrowing, together with small birds, frogs and snails, which he catches outside at night. He has a tremendous appetite for so small an animal, and seizes upon and eats his prey in a ravenous manner. He can run very rapidly underground, and will fight ferociously with other Moles, or with animals, like the weasel, which attack him. On the surface of the earth, he is awkward and clumsy, no doubt because he is out of his element, and he is especially helpless in the daytime, because of the pain he suffers from the strong light of the sun. The Mole is a good swimmer and will sometimes take to the water to escape a pursuer.

The fur of this animal is always very clean, which is to be wondered at when we think how much of his time is spent in forcing his way through earth. The fact that he is not soiled by contact with the earth is explained when we examine his fur. Instead of the hairs being large at the bottom and tapering toward the outer end, or of even thickness throughout, as in other animals, they are small where they leave the skin and increase in thickness toward the center, growing smaller again at the outer ends. This is the reason his fur is not ruffled by being rubbed in any direction, and explains why it does not take up the earth as readily as the hair of other animals does. But there is still another reason why "dust does not stick to him." Under the Mole's skin there is a strong muscle-membrane, and from time to time he moves this muscle violently so as to shake the earth from his fur.

Several species of the Mole are found in the United States, including the common Shrew Mole, the Silver Mole, whose fur is of a silvery gray color, and the Black Mole of Oregon, whose fur shows changing reflections of purple and brown. There is also a kind called the Star-nosed Mole which has a nose shaped at the end like a star with several points. In Africa, near the Cape of Good Hope, is found a Mole whose fur reflects beautiful hues of green and gold.

#### THE PLATIPUS

THE Duck Mole, or Duck-billed Platipus, is not really a mole at all, but belongs to a wholly different order. He is found in Australia, and seems to be a combination of animal, fish and bird, for he not only burrows in the earth, like the common Mole, but spends



much of his time in the water, like a fish, has a bill like that of a duck, and lays eggs, like a bird.

The Platipus is much larger than the American Mole, and, including his tail, is sometimes two feet in length. He has a broad, flat tail, and is provided with stubby toes, made for digging, and so webbed that he can swim the more easily.

His strong beak, or bill, is used in seizing frogs and other prey, as well as in digging, and when the animal is attacked, he strikes sharp blows with it. The eggs laid by the Platipus are soft-shelled, like turtle eggs. The creature's outer fur is dark brown, with a tinge of silver at the tips of the hairs, and the inner hair which is gray, is soft and fine like that of the seal.

## THE SKUNK

THE Skunk is an independent little animal, never troubling to go far out of his way to accommodate others, and as a rule his rights are respected and he is let severely alone. He looks from a little distance like a black and white cat with a bushy tail.

He is a common animal in the United States, and sometimes makes his appearance in the streets of cities, although his home is in the woods and fields. A hollow tree, a crevice in the rock or a wood-pile serves him for a dwelling, and if none of these is at hand he will dig a burrow in the ground, as a weasel does, for the weasel and the Skunk belong to the same family. Night is the Skunk's time to go in quest of food, although he sometimes appears by day, as well. Insects, worms, berries, roots, small birds and animals furnish him food, and he has a well-developed liking for poultry and eggs, so that the farmer's chickens are often stolen by this night raider.

The Skunk does not use his teeth nor his claws to defend himself from his enemies, for he has a much more effective means of keeping them at a distance. If frightened or angry, he stands his ground, stamps in an excited fashion and throws his long bushy tail over his back, as a squirrel sometimes does. When the enemy comes nearer, the Skunk throws from a gland near the root of his tail a most offensive secretion, the odor of which is overpowering. If it is a dog that has presumed to disturb the Skunk, the intruder's nose, eyes and mouth are filled with the horrible stuff and he rolls on the ground in agony or rushes away to find water into which he may plunge. Other animals than the dog receive similar treatment, and so powerful is the Skunk's secretion that the animal into whose eyes it has been thrown is temporarily blinded.



FROM COL. CH1. ACAD. SCIENCES.

COMMON MOLE.  
3/ life-size

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From coll. Mr. F. Kaempter.  
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SKUNK.  
2  $\frac{1}{2}$  Life-size

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The Skunk is so innocent-looking, and so little afraid of being injured, that persons sometimes approach him and are covered with the fluid before they realize their danger. A young lad, whose home was in the city, once paid a visit to his uncle in the country, and while returning from a neighboring farm, where he had been to call on a lad of his own age, he spied by the roadside what he thought was an Angora cat. The creature seemed to be hopping about and ready to play, so he ran forward to pet it, when suddenly the air was filled with a stifling odor, and his clothes were drenched with the secretion of a Skunk. He ran to his uncle's house, terrified by his experience. His clothing, including his new suit, underwear, shoes, and hat, were buried in the ground, and not until several weeks after his return to the city had the earth absorbed the odor from the garments so that his uncle could send them to him for further use. His hair and skin also retained the odor for some time.

A lady and gentleman driving in the country had a similar experience. Dusk was coming on, and by ill luck the horse's hoof disturbed a Skunk, which was crossing the road. Instantly, the air was filled with the familiar pungent odor, and the clothing of the gentleman and his companion, the cushion and robes of the carriage, the harness and the horse's hide, were drenched. The cushions, robes, and harness were buried under ground to remove the scent, and the carriage was repainted, but even after several successive coats of paint had been applied, the odor could be detected.

It is easy to understand why the Skunk, with a means of defense like this, is always allowed to choose his own side of the road when a person meets him. The animal retains his secretion when good-natured, and may be tamed, but there is too much likelihood that he may at any time imagine he has been insulted, to make him an entirely safe companion. He takes good care that his own person shall not be soiled, by throwing the secretion behind him.

The fur of the Skunk, when prime, is of considerable value. In some Skunks the fur is entirely white, and is then worth little; in others, black is mingled with the white, and in still others, black is the chief color, with spots or stripes of white. The fur of the black Skunk is the most valuable. To offer for sale "Skunk's Fur" would not sound very attractive, but the furrier calls it "Alaska sable" and under that name many ladies admire it greatly. The skins are worth a dollar each, and in some places men carry on "Skunk farms," where they raise the animal in order to obtain its fur.



## THE COMMON MINK OF THE EASTERN STATES

FOR so small a creature, the Mink has a remarkable appetite. He is always on the lookout for something to eat, and as he runs about both by night and by day, it is hard to say when he sleeps. The Mink is from twelve to sixteen inches long, with a small head and a large tail. His habits are much like those of the otter. He has the same kind of burrow, in the bank of a stream, with a tunnel leading to the water, for the Mink's toes are partly webbed and he is a good swimmer. He does not always take the trouble to dig his own burrow, but instead, drives a muskrat from his hole or kills and eats him, and then settles himself comfortably in the muskrat's abode. At other times, he makes a nest under the roots of trees, or between rocks, and as he often pays visits to the farmer's poultry yard, he may be bold enough to make a nest under the barn, so that he may live near his hunting-ground.

The Mink finds food both in the water and on land. He catches fish, frogs, muskrats, crawfish, snails and water-insects, and is fond of ducks, chickens, and eggs. He even catches birds, and can climb trees to get at their nests, although he usually prefers to remain on the ground, unless chased by dogs or other enemies.

The fur of the Mink is a rich dark brown or black, in color, and up to the time that sealskin came into general use, was one of the most popular of the fancy furs, a single skin of the best quality being worth ten or twelve dollars.

## THE BEAVER

THE Beaver looks very much like an enormous rat. His body is from two to two and one-half feet in length, and sometimes weighs as much as sixty pounds. His most remarkable feature is his broad flat tail, whose principal use is as a sculling oar in swimming and diving. The Beaver is a gnawing animal, and has strong front teeth, with which he often cuts down large trees. His hind feet are webbed, to assist him in swimming, for he is one of the animals that live partly in the water and partly on the land.

Formerly the Beaver was found in large numbers throughout the eastern and middle portions of the United States, but his fine fur is so valuable that he has been exterminated by hunters and trappers in the more thickly settled states. He still thrives, however, in the northern part of the United States, in the Rocky Mountains, in Canada, and

in the region around Hudson Bay. You may have seen a picture of the Beaver on some of the Canadian postage-stamps, where it was used as a symbol of the industry of the Canadian people.

The Beaver makes his home in brooks or rivers, and sometimes on the shore of a lake or pond. He must have a sufficient depth of water, so that in winter he will have room to swim beneath the ice. To make sure of this, he dams the stream which he has selected at a suitable place in which to build his house ; this is to make the water deeper. In building his dam and his house, the Beaver shows remarkable intelligence. First, he selects a number of large trees, sometimes two feet in diameter, growing near the banks of the stream, and with his sharp teeth he gnaws through them near the ground, making the deepest cut on the side next to the stream, so that when the tree goes down it will fall into the water. Woodchoppers follow the same plan in cutting down a tree, so that it will fall in the desired place. When the Beaver has felled the tree, he cuts off the limbs, and then divides the trunk into short logs. All of this he does with his teeth. If there are no large trees growing near the stream, the Beaver digs a canal leading into the forest, so that he can float the trees when he has felled them. Several Beavers now unite to drag and push the logs to the place they have selected for their dam, where they weight them down with a great number of stones. In this way they build a foundation, which is sometimes ten feet wide, across the stream. They then add more logs and branches, and fill up the spaces between them with stones and mud, until the whole is cemented together in a solid mass. Other branches and leaves which float down stream from above, lodge against the dam and help to strengthen it, so that, as time goes on, it grows stronger, and grass, and even trees, grow on the top. As soon as the dam is well advanced, the water above it rises and forms a pond, and the Beaver is then ready to build his house, which is called a "Beaver lodge." He begins by making a foundation on the bottom of the stream, just as he did in building the dam, and then adds branches, moss, and stones, which he cements together with mud. The house is built higher and higher, until it has risen several feet above the surface of the water. The Beaver plasters the outside with mud, until it is perfectly smooth and round. In winter, when the snow covers the ground, it looks like a small Eskimo hut made of sticks.

The Beaver lives in the part of the house that is above water, in a chamber which he lines with grass and leaves, so as to make it snug and comfortable. At the top of the house, he leaves an opening for ventilation, and over this opening he places branches to keep out the snow and rain.



Beavers live in colonies, and work together in building their dams and huts. Six or seven may live in one hut, but fifteen or twenty huts may be necessary for a whole colony. The door of each hut is under water, and all of these doors open into a trench dug in the bottom of the stream, where the water is not likely to freeze in winter. The walls of the house are very thick, and when the cold has frozen the mud with which they are plastered, the Beaver's worst enemy, the wolverine, cannot break through them. Even hunters find it a difficult task to cut through these walls, which are often five or six feet in thickness.

The Beaver has lungs for breathing air, as we have, but he can swim for some distance under ice, and when he needs fresh air he rises to the top of the water and expels the air from his lungs. This forms a bubble under the ice, and the air in the bubble is soon made fresh by the oxygen it absorbs from the ice and the water. The Beaver then draws it into his lungs again, and swims on as before.

This animal feeds chiefly on the bark of trees and on plants that grow in the water. In order to have an ample food supply in winter, it brings plenty of the smaller trunks of poplar trees and anchors them in the bottom of the stream, near his house.

When warm weather comes, the Beaver leaves his snug house and makes a summer home by burrowing in the bank of a stream. This burrow has a door under water, and the Beaver sometimes takes refuge in it during the winter, when the hunters or the wolverines frighten him from his hut in the stream.

Like other animals which spend a part of their time in the water, the Beaver has two coats of fur. The outer fur is long, and reddish-brown in color. That next to the skin is fine and soft, and is very valuable. Felt hats were originally called "beavers" because the fine fur of this animal was used to make their covering.

Beavers do the most of their work at night, and they are never idle during their working hours. To say that one has worked "as hard as a beaver" means that he has been very busy indeed.

## THE MUSKRAT

THE Muskrat, sometimes called the Musquash, is somewhat like a beaver of smaller growth. He is found throughout the United States, except in the extreme south, both in the country and on the outskirts of cities.

He is as large as a kitten, and has a long, flattened tail, not so broad and flat as that of the beaver, but still useful to him as an oar.









He has strong teeth for gnawing, and cuts down rushes, as the beaver fells trees, to build a kind of lodge.

The Muskrat has an advantage over the beaver in making his home near civilized communities, for, in addition to feeding on water-plants, and the bark of trees, he often makes a dinner of carrots, potatoes, apples, and other fruits and vegetables, which he finds in the fields. The Muskrat is so called because he carries about him a strong odor of musk.

It would seem that this fact would prevent his flesh from being useful as food, but at most seasons, if the animal be skinned and cleaned at once after it is killed, the flesh is found to be free from the musky odor, and is highly esteemed as food among the Indians and white hunters and trappers.

The Muskrat's skin, although not as valuable as that of the beaver, commands a ready sale. Its price is very low, but such quantities are collected that the trade in the skins is important. The soft fur nearest the skin is sometimes dyed and made to serve as an imitation of sealskin. Muskrats are fond of play, and may be seen at night gamboling in the water, swimming and jumping like frogs.

## THE AMERICAN OTTER

**D**ID you ever wonder why a duck swims so easily? It is because there is a web of skin stretching between his toes, so that he has a broad paddle with which to beat back the water. Nature has provided some animals with feet very much like those of the duck, which enable him to swim easily and swiftly and naturally. These paddle-like feet have been given to animals which are expected to get the greater part of their food from the water.

The American Otter is one of these web-footed animals. He is found in the United States and in Canada, making his home along the banks of streams. The entrance to this home is three or four feet below the surface of the water, where he digs a tunnel leading upward, at a gradual slant, into the bank. At the end of this tunnel he makes a comfortable chamber, which he lines with grass and leaves, and, as he likes to have his home well ventilated, he digs a small shaft upward from this nest to the surface of the ground, for an air-hole.

When the stream near which he lives is flooded, the water sometimes rises so high in the Otter's tunnel that he is forced to abandon his home for fear of being drowned. In such cases, he goes outside and finds temporary lodging in the trunk of a hollow tree. When



the water goes down, he returns to his nest in the bank, or makes a new burrow in some other place. As he knows the water in the stream may rise suddenly, he sometimes builds three or four houses, hoping that at least one of them will not be flooded.

If an Otter is frightened while on the bank, he quickly dives into the water and makes his way leisurely to his home. It is no easy matter to find the entrance from outside, so that when he has once escaped to the water, he is generally safe from pursuit.

The Otter is as heavy as a small dog, but stands lower; he has a very blunt nose and a long, thick tail, which tapers toward the end. This tail serves as a rudder by which he may steer himself in the water, and Nature has taken such care to make him a good swimmer that she has also made his joints flexible, so that he can turn his legs in almost any direction.

After sunset, he goes out to find his dinner. By beating the water with his broad tail, he frightens the fish so that they quickly hide under stones or beneath the edges of the bank. The Otter knows about these hiding-places, however, and as soon as he thinks the fish have been frightened by the noise he makes, he darts into their retreat and soon finds his prey. Holding it in his mouth, he swims to the bank and there takes his own time to eat it. He catches frogs and crabs, as well as fish, and sometimes secures a small bird.

The Otter becomes a fierce creature when he is attacked. He will snap and bite at his pursuer, and is often able to seize a dog's nose and make him howl with pain. But the Otter is easily tamed, and will stay contentedly about the house, playing with the dog and the cat and performing little tricks, which he learns readily. He seems to have a liking for fun, and enjoys sliding down hill as much as any boy or girl does.

"Sliding down hill!" you exclaim. To be sure; boys and girls have no right to monopolize that sport, if the animals wish to share it with them. The Otter selects as high a ridge as he can find, and then, lying flat on his body, just as a boy does on his sled, he doubles his forefeet under him and away he goes over the snow. He will continue this sport for hours, until he is thoroughly tired out. He would like to slide down hill the year around, and in summer, if he can find a sloping bank of smooth clay, he uses that for a slide, in place of the winter's snow. He also slides on the ice, running a few feet to get a start and then throwing himself down flat.

The Otter's fur is very valuable, and men hunt him wherever he is to be found. He really has two coats of fur. The under coat, next to the skin, which keeps him warm in winter, is very fine and soft—almost like down. Over this there is an outer coat of coarser hair,

long and shining, which Nature has given him to help him to glide more easily through the water. When the Otter's skin is taken to market, the furrier pulls out these long, coarse hairs and leaves only the soft, fine fur. This is a rich dark brown in color, and makes very handsome garments, which are also very expensive.

## THE RACCOON

THE Raccoon is a member of the bear family, but, unlike the bear, he has a long and bushy tail. We usually shorten his name to "Coon." Dogs called "Ccon-dogs" are trained to hunt this animal. The Coon's fur is long, and is gray or yellowish-gray in color, except for a band of black across his face. His tail also has rings of black at intervals throughout its length.

This animal usually makes his home in a hollow tree, and prefers to be near the water, for he eats frogs, clams, oysters, and turtle's eggs. He will turn up stones to get at the spiders and bugs underneath, which he eats as an occasional relish. He is fond of nuts and fruits, birds' eggs, and green corn, and preys on small animals, such as rabbits and squirrels, and on birds. Like the bear, he has a fondness for sweet things, and a taste of honey pleases him greatly. When he eats he sits up on his hind legs and holds his food in his forepaws, just as you have seen a squirrel do with a nut.

The Coon's claws are sharp, and he is a good climber. The track he makes in walking is much like that of a baby's foot.

The Coon is found in nearly every part of the United States. In the North, he lies dormant in winter, as the bear does, but in the South he is active through the entire year.

Night is the Coon's time to go abroad. The strong light of the sun makes him blink, and if he chances to be far from home when day breaks, he will climb a tree, curl up in a ball, and, protected from the sun by the thick foliage, remain there until the next night.

Coon-hunting is a favorite amusement among farmers' boys. A moonlight night is the time usually chosen, and a reliable "coon-dog" is set on the trail, while the hunters follow with axes, clubs, and torches. The Coon will sometimes run a considerable distance before he seeks safety in a tree, but when the dog has "treed his Coon," he barks loudly to attract the hunters to the spot. It is not easy to get a shot at the animal, for he lies concealed among the branches in the darkest part of the tree, and as he clings firmly to his perch with his long claws, he cannot be shaken off. So it is necessary to chop the tree down, and while this is being done, the hunters and dogs



watch for the Coon to leap and run when the tree falls. Once on the ground, he is soon shot or is dispatched by the dogs.

A young Coon may easily be tamed, and will become a very interesting pet. He is very curious as to what goes on about him, and is an expert pickpocket, often searching with his nose for candies or other goodies, which he thinks he may find in his master's clothing. He may be taught to do tricks, such as to go to a basin of water and wash his face with his paws, or to stand erect when told to do so.

Coon skins are of some value in making fur garments, and always bring a small price. Hunters often make caps and other articles of wearing apparel from these skins. The flesh of the Coon is edible, and, among the colored people of the South, is considered a great delicacy.

## THE OPOSSUM

**I**N MANY respects the Opossum resembles the Raccoon, although he is not so bright and clever an animal. He is usually about the size of a large cat, and has grayish fur, which is tipped with white, so that it appears a dingy white. His very short legs bring his body close to the dust.

The most remarkable part of the Opossum is his tail, which is about fifteen inches long, and without hair, for the most part, but covered with small scales. By means of this tail, which he wraps around the limb of a tree, he often hangs head downward and eats persimmons or other fruit at his ease.

The Opossum is found in the middle and southern parts of the central and eastern United States, where a "possum hunt" is considered as great sport as a "coon hunt."

The Opossum lives in a hollow tree, or makes a nest under an overhanging rock. He dislikes the sun even more than the Raccoon does, and goes in search of food only at night.

He feeds on rats, mice, eggs, nuts and berries, and is fond of grapes and persimmons. At times he raids a hen-coop, but usually remains only long enough to get a chicken, which he carries away to eat.

The colored people of the South are very fond of the flesh of the Opossum, and have many an exciting night-hunt after him in the woods. Roast "possum," with sweet potatoes and green corn as side dishes, makes a repast of which they are very fond.

This is one of the few animals found in North America that has a pouch in which to carry its young. The kangaroo, which is a native of Australia, is provided with a similar pouch. As soon as the little Opossums are born, the mother puts them into her pouch,



FROM COL. CHI. ACAD. SCIENCES.

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OPOSSUM.  
 $\frac{1}{8}$  Life-size.

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FROM COL. F. KAEMPFER.

GOPHER.  
5/6 Life-size.

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and carries them there until they are about five weeks old, when they are able to run about on the ground. When they first go out for a walk with their mother, they wind their tails around hers, and the whole family presents an amusing sight as its members trot along thus linked together.

In South America is found a variety of this animal called the Crab-eating Opossum, from the fact that crabs are his chief article of food. He lives near swamps and streams, where he may readily catch crabs, and spends the greater part of his time in trees, except when he descends to find food. His fur is shorter, and his claws longer, than those of the Opossum found in the United States, and he has a long snout which gives him a rat-like appearance.

### THE STRIPED GOPHER

**T**HE Striped Gopher is a bright-looking little fellow, about the size of a squirrel, and his fur is marked something like that of the ground-squirrel, or chipmunk. His long tail, however, is not so bushy as that of the squirrel, and his ears are less pointed.

He is found chiefly in the northern part of that section of the United States which lies between the Mississippi River and the Rocky Mountains. His head, ears, and eyes are shaped much like those of the common rat, and in his cheeks he has two remarkable pouches, in which he carries his food from the place where he obtains it to his underground storehouse.

Like the mole, he burrows underground in many directions, and throws the earth up, at frequent intervals, in little hillocks. The nest of the Gopher is usually found four or five feet under ground, and the entrance tunnel twists about like a spiral staircase. He lines his nest with grass, and in an adjoining chamber he keeps his winter's store of food, which consists of seeds, nuts, roots, and other vegetables.

The farmer is the sworn foe of the Gopher, for the little animal not only undermines the soil, but feeds on the roots of the vegetables, and grain, often doing great damage to the crops and to many kinds of trees. He keeps out of sight as much as possible, and is enabled to avoid observation no little by the color of his coat matching the dry grass. He sits erect on his hind legs, at the entrance to his burrow, like a squirrel, and at the first appearance of an enemy whisks back into his hole.

The Gopher may be tamed and makes an attractive pet, but when kept in captivity, he will gnaw his way to liberty through almost anything, except iron or stone.



## THE AMERICAN BADGER

THE Badger is one of the burrowing animals, and is found principally in the northwestern part of the United States. Wisconsin is sometimes called the "Badger State," because of the great number of these animals found within its territory.

In size, the Badger is a little smaller than the fox. He has a long, narrow head and a short tail. Above ground he seems to be a clumsy, sluggish animal, but when he begins to dig, he becomes active and energetic. He makes his home in a burrow in the ground, and where there is a large colony of Badgers, their operations underground cause much trouble to the farmer, as they undermine the soil and injure growing crops.

The Badger catches rats, mice, gophers, moles and other small animals, and is very fond of honey. He digs open the nests of wild bees, which he finds in the earth, and devours both the honey and the wax. Apparently he pays no attention to the swarm of angry bees which surround him when he raids their nests, his thick fur affording ample protection against their stings.

Clumsy as he looks, the Badger is a cunning fellow, and is very clever in avoiding the traps which are set to catch him. If captured alive, he readily yields to good treatment and becomes quite tame.

A white stripe extends from the Badger's nose over the top of his head, and stripes of black run backward from his eyes. Except for these marks, the fur of the animal is gray.

Badger skins have at times been in high favor for use in making fur garments, which were quite expensive, but the skins are now worth only about one dollar each.

The hair is used to a considerable extent in making paint-brushes, a "Badger blender" is one of the requisites of an artist's outfit.

## THE RED SQUIRREL OR CHICAREE

OF ALL the smaller animals of our native woods, none is so bright and enterprising as the Red Squirrel. He has a pert manner, which almost makes us think that he considers himself a very fine animal. He takes great care to keep his coat clean and glossy, and his big bushy tail, which he curves so gracefully over his back, is always fluffy and tidy as can be.

Besides the Red, there are several other species of Squirrel in this country, including the Gray Squirrel, the Fox Squirrel, and the Chipmunk, or Ground Squirrel, which has a suit of fawn color striped with

black and white. The Squirrels of other countries are much like our own, and the world over the habits of the Squirrel family show little variation. They spend the greater part of their lives in trees, frisking from branch to branch, and making long jumps with apparent ease. In making these jumps, their bushy tails serve them well, both as a rudder to steer them and as a parachute to break the fall, like that used by a balloonist. That these are the real uses of the tail is shown by the fact that they cannot jump so far nor be so sure of landing safely, if the tail is cut off.

The long, sharp claws of the Red Squirrel are very useful to him in climbing. By their aid, he can scamper up the trunk as fast as he can run on the ground. The Squirrel never trots and rarely walks, but goes over the ground in a succession of bounds, just as do his relatives, the rabbits and hares. He is wonderfully quick in all his movements, but he has need of all possible safeguards against his enemies, for of these he has many dangerous ones besides man and his gun. Among these are the hawk and the owl, which swoop down upon him from the air, and catch him unawares.

Nuts, fruits, grain, the tender buds of trees, birds' eggs, and even mice, furnish food for this nimble little creature. It is interesting to watch him as he eats a nut. He sits up on his hind legs, with his tail curved over his back, and, holding the nut in his fore-paws, he attacks it with his two long, sharp, front teeth, which are especially designed for gnawing. He first drills a small hole in the shell of the nut, and then breaks away the shell a little at a time, until he can get at the sweet kernel, which he eats with the greatest relish. Having finished eating the nut, he jerks his long tail, and, in a twinkling, he is off again for another nut. Red Squirrels make their nests underground or in hollow trees, and it is said that they have three or four separate nests, so that if one should be discovered and raided by an enemy, they may still find shelter. Nature has taught the Squirrel to store in his nests during summer and autumn a supply of food to last through the winter, when the ground is covered with snow.

He coolly takes for his own use nests built by the crow or other birds, sometimes selecting a woodpecker's nest in a hollow tree; or else burrows in the ground and makes the underground nest warm and comfortable with a lining of leaves and grass.

As soon as nuts are ripe in the fall, the Red Squirrel begins to lay in his winter's stock of provisions, and he never makes the mistake of putting away worm-eaten or moldy nuts. Sometimes he steals the farmer's corn and stores that away along with his other supplies.

It is surprising to see how large a store of nuts this Squirrel will lay by for winter use, several quarts being sometimes found in his



nest. He must make many trips to the chestnut grove or the hickory nut trees, and to the cornfield as well, before he is satisfied that his supply is sufficient.

Sometimes the Red Squirrel is bold enough to make his nest in the farmer's barn, but if the farmer discovers the thief who steals his grain, Mr. Squirrel is in danger of being captured or shot. We may imagine that it is only the lazy Squirrel, which does not want to be at the trouble of making a nest in the woods and storing up his own provisions, that dares actually to settle down in a barn, prepared to live through the winter on the grain somebody else has worked or paid for. Yet there are people just like that kind of Squirrel. The little fellow is very shy, and is so much afraid that he may be intruded upon that he always makes a private back-door to his nest, through which he may escape if an enemy comes in at the front door. If captured, however, and kindly treated, the Red Squirrel, after a time, becomes very friendly.

Perhaps you have been to Central Park in New York, and have seen the Gray Squirrels frisking about under the trees. They are so tame that they fear no one, for any one harming them is punishable by law. In the State House grounds at Richmond, Virginia, are hundreds of beautiful Gray Squirrels, some of which are so tame that they will eat from the hands of strangers. No one ever thinks of harming them, and dogs are not welcome on the premises, for both dogs and cats seem to regard the Squirrel as lawful prey, and can never be wholly reconciled to their presence in the household as pets.

It seems a pity to think of eating such bright little creatures, but it will not do to deny that squirrel-pie is a very appetizing dish. The fur of the Black and Gray Squirrels is valuable and is used in making muffs, boas and tippetts. The fine fur from the Squirrel's tail is used in making certain kinds of brushes.

Perhaps you wonder why this little animal is called the Squirrel. The man who first gave it a name spoke Greek and he called it, in his language, *Skiurus*, a word which means, "The one under the shadow of his tail." The name Chicaree was suggested by one of their many chattering notes.

### THE FLYING-SQUIRREL

THE Flying-Squirrel has a body much like that of other Squirrels, and the same long, bushy tail, but he has also been provided with a strong membrane or skin which extends outwardly from his body and stretches from leg to leg. When the Squirrel jumps into the air and stretches out his feet, this membrane is extended so





From col. F M Woodruff

RED SQUIRREL.  
¾ Life-size.

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that it offers a large surface to resist the air, and instead of going straight down when he jumps from a height, he sails through the air in much the same way that we often see a barn-swallow or a hawk do. He uses his tail as a rudder and steers himself. In this way it holds the Squirrel up so as to alight where he wishes.

If you do not understand just why this is so, take a lead pencil and drop it to the floor. It will go straight downward. Now push the pencil through two holes at the end of a sheet of note paper, and holding the paper in a horizontal position, drop it with a gentle push forward. You will see that the paper holds the pencil up and that it will float down in a slanting direction much more slowly than when the pencil had no paper to support it. To the Flying-Squirrel the membrane stretched between his feet acts as the sheet of note paper does—it not only holds the Squirrel's body up so that he may not fall too rapidly, but also makes it move sideways for a long distance, and this is what is known as the flying of the Squirrel.

The Flying-Squirrel does not frisk about in the trees during the day, as other Squirrels do. He remains quietly in his nest until night comes, and then goes out to look for nuts and other food. In other respects his habits are like those of the Squirrels we see by day.

The Flying-Squirrel we have in this country is a little creature whose body is about as large as that of a chipmunk; but in other countries they have Flying-Squirrels that grow to be as large as a cat.

The fur of this little creature, which covers not only the body but the upper side of the membrane, is very soft and fine, and its owner takes the best of care of it. He washes his face with his paws, as a cat does, and combs his fur with his long claws, and then smooths it down with the soles of his feet.

The owl, which also goes abroad at night, is one of the most dangerous enemies of the Flying-Squirrel, and if puss happens to be in the neighborhood, she also will watch for an opportunity to pounce upon the little animal as she would upon a mouse.

## THE BAT

As THEY circle about in the air and fly almost against our faces, sweeping down upon us in a most startling way, and all without noise, the common Bats of our country are weird creatures and seem ready to do us harm. But, on the contrary, they are the most harmless creatures imaginable, and may even be tamed so as to become very much attached to their masters.



“As blind as a bat” is not a truthful description of a person who cannot see, for the Bat has eyes, although he depends less upon sight than upon his marvelous sense of feeling.

These queer creatures sleep during the day, in dark places high up under the rafters of a barn or in a garret, and there we may be able to catch one and see what he is like.

From their swift flight through the air, we might think that they had wings like birds, but birds have feathers, while Bats are covered with soft fur. Their wings are not like those of a bird, but consist of a tough, leather-like membrane or skin which extends from the sides of the body to the ends of the feet.

The legs are very slender. The hind feet are provided with claws, and from the extremity of the fore legs or hands are four long, bony fingers that pass through the membrane which forms the wings and support it. At the top of the wing is the thumb, with a sharp claw that is a very useful hook. Bats can fold their wings by drawing them close to their body as you would close an umbrella. When they rest or sleep, these odd creatures hang head downward, holding to their perch by means of the claws of their hind feet. They walk with difficulty, and present an awkward appearance as they move over the ground, dragging themselves forward by means of the hooks on their wings. They dislike to rise from the ground into the air, because although they can do it, it is not without considerable difficulty.

Bats' wings seem to have a delicate nervous organism that enables them to feel that they are approaching an object before they have actually touched it, and then they quickly alter their course and fly in another direction. They depend much more upon their sense of feeling than upon sight, and this explains why a Bat which has almost touched us will suddenly wheel away to avoid contact.

One remarkable thing about the Bat's fur is that when closely examined under the microscope each hair is seen to have the twisting form of a screw.

As we watch the Bat's flight, it seems aimless, as we never see the creature alight, but it is while flying that the Bat gets his food. He feeds wholly upon insects, chiefly those that fly by night, and at every sudden turn we see him make, we may assume that he has captured an insect for food.

In cold countries, where there are no insects flying through the air in winter, Bats must do without food, so they retire to some dark place and sleep throughout the winter, hanging head downward. They never willingly remain in a horizontal position for more than a few minutes at a time. It seems probable, then, that some bats follow the example of the birds and serpents on the approach of cold weather.









Bats increase in number as we go farther south, and in tropical countries they exist in great swarms. Travelers have seen Bats fly from the caves in which they made their homes, in so dense a column that at a short distance it gave the appearance of a thick volume of smoke rising in the air, the swarm numbering probably millions of Bats.

The common Bats of our country, shown in the illustration, have bodies only two and a half or three inches long, but their wings, when extended, measure from eight to twelve inches across the widest part. In warmer climates, there are much larger kinds. In the Philippine Islands are huge Bats which have a body the size of a kitten, and whose wings measure from three to four feet across. They feed ravenously upon fruits and it has been feared that they might be brought to this country, where they would be a terrible pest to the farmers. The United States government has taken steps to prevent their introduction here.

## THE MONKEYS

SEVERAL species of the creatures called Monkeys bear a marked resemblance to man in both form and face, and for this reason they have long been the subject of close study on the part of naturalists and others. Monkeys are found chiefly in tropical countries, where they have existed from time immemorial, and vary in size from the tiny marmosets, no larger than a squirrel, to the powerful Gorilla, which is as large as a man.

These queer creatures usually dwell in forests, but, in some cases, make their homes on rocky cliffs. Their food consists principally of plants, fruits, nuts and other vegetable matter.

Monkeys have four hands and are thus especially fitted for climbing, and for grasping objects securely. Most Monkeys spend the greater part of their time in trees. With one hand the animal can cling to a branch, while he makes use of the three others as he may desire. Monkeys have a natural tendency to walk on all-fours instead of standing upright like a man; their fingers turn in, so that they walk on their knuckles instead of on the palm of the hand.

Of all the kinds of monkeys, the Gorilla and the Chimpanzee most nearly resemble man, and the skeleton of one of these animals looks very much like that of a human being, except that the arms are longer than the legs and hang below the knees when the creature stands upright.

The Gorilla is found only in the wildest parts of the central forest of Western Africa. He is the largest member of the Monkey family,



and is sometimes nearly six feet in height. His body is proportionally larger than that of a man, but his legs are very short. His skin is black and is covered with hair of the same color. It is this covering of hair, with which all Monkeys are provided, that immediately distinguishes this animal from man. Many of these creatures have hairless faces, however, and this gives them the appearance of being dressed in a complete suit of fur, with a close-fitting hood. Some of the smaller varieties of Monkeys are nearly hairless, and this fact is pointed to by naturalists as a proof that under certain circumstances the hair disappears and their bodies become nearly naked, like that of man.

The Gorilla is exceedingly fierce, and cannot be tamed after he has grown to full size. If wounded by the hunter, he proves a dangerous enemy and sometimes it requires a quick and sure rifle-shot to save the hunter's life, for one blow of the Gorilla's mighty arm will crush a man's skull. He can hurl a large stone with great force at an approaching enemy, and will even use the heavy limb of a tree as a weapon. When he is wounded or angry, his roar is terrifying, and as he advances upon his enemy, roaring and beating his breast with his enormous hands, he is an object to inspire dread in the stoutest heart.

Next in size to the Gorilla are the Chimpanzee and the Orang-outang. The Chimpanzee is the larger of these, being easily about four feet in height, but sometimes much more. His arms are more like a man's than those found in any other Monkey, and his large ears, eyebrows, eyelashes and whiskers are much like those of human beings. This creature has a lively and intelligent disposition, and is apparently very fond of human society. For many years there was in the Zoölogical Museum in Central Park, New York, a Chimpanzee named "Mr. Crowley," whose intelligence made him famous. When he died, many of the newspapers of the country gave him an "obituary notice," just as they would have done if he had been a public man. A Chimpanzee may easily be taught to eat with a knife and fork, use a napkin at table, smoke a pipe, drink water from a glass and do many other things that men do. He will accept a piece of cake with a polite bow and eat it with every evidence of good breeding. A gentleman living in Africa once had a tame Chimpanzee which always desired to clean up the room after his meals, and would sweep with a broom, dust off the furniture, and set things to rights as a housemaid would do.

The Orang-outang is a species of Monkey found only in the islands of Borneo and Sumatra. He lives in swampy forests near the coast, and spends his time in the treetops. He is one of the largest apes,

though he is not as tall as the Gorilla. His motions are slow, and when in captivity he becomes very melancholy, in marked contrast to the lively Chimpanzee. His name means "the wild man of the woods."

The Gibbon, or Long-armed Ape, is found in southeastern Asia and the Indian Archipelago. He is a gentle and very active creature, and swings from tree to tree, devoting most of his time to sport. His voice approaches nearer to that of a man than do those of the other Monkeys.

All of the Monkeys mentioned thus far are without tails, and these kinds are sometimes called Apes to distinguish them from those having long tails. The Baboon belongs to the tailed class. His head is shaped very differently from that of the Chimpanzee, and is so much like a dog's that he is often called the "dog-faced" Monkey. Chimpanzees, Gorillas and other Monkeys, have noses which, though flattened, resemble our own, but the Baboon's nose is more like that of the dog, the nostrils being at the end of the nose, and not underneath. Baboons are found chiefly in Arabia, and Africa, and in the wild states they are always "bad Monkeys." They are malicious and quarrelsome, and seem to have intelligence enough to know when they are doing mischief and appear to delight in it. The leopard is one of their most dangerous enemies, but if attacked either by him or by a human being, they will defend themselves in a courageous and cunning manner. The Baboon eats fruit and vegetables, and delights to raid a vineyard or an orchard. He also eats eggs, insects, chickens and even the deadly scorpion, whose poisonous tail he first breaks off. The Baboon often becomes very tame, but as he grows older he becomes more and more sly and mischievous. He is fond of alcoholic liquors, and if allowed to do so will drink until intoxicated. While he does not hesitate to stand his ground on ordinary occasions, and will slap and bite a dog until he howls for mercy, he is very much afraid of snakes and all other creeping things; even a small lizard causes him great uneasiness and alarm. Baboons spend less of their time in trees than other Monkeys do and as a rule make their homes among rocks.

The Mandrill is a baboon that is remarkable for his bright coloring. His cheeks are blue, his nose is red and his beard is yellow, so that he presents a curious and not very pleasing appearance. He is a very savage and powerful creature.

The hair of most Monkeys is gray or black in color, but there are exceptions to this rule. The Diana Monkey, found in Africa, is dark brown on the back, and bright orange on the under part of his body, and is striped with bands of black and gray, while his beard



is pure white. The Bhunder Monkey, a native of India, has hair that is olive-green, brown and yellow. He is regarded as sacred by the natives; they never molest him, even when he has done great damage to fields and vineyards.

The Monkeys of the new world are all small in size, and are remarkable for their long, prehensile tails.

The South American Spider Monkey, so called because his arms and legs are very long and slender, has a long tail which he uses like a fifth hand, grasping objects with it or hanging by it from a branch, thus having his four hands free for other purposes. The old world Monkeys use their tails to steady themselves, only those of America can suspend their whole weight by that member.

Other species of Monkeys that are found in South America are the Howling Monkey, which has a strong voice and howls dismally in the night, and the Marmoset, a small, graceful little Monkey, which has tufts of hair on the back of his head that give him the appearance of having a ruffled collar.

These little Marmosets are easily tamed and are very playful creatures. A Washington lady had one given to her as a pet and he soon gained the freedom of the house. He was not larger than a squirrel, but his tail was eight or ten inches long. He would swing downward from the gas-fixture sometimes, and then make a long jump, usually to the head of the nearest person. One day his mistress's husband was shaving, when the Monkey jumped from the chandelier and dropped on the man's bald head. There was no accident, but after that the man made sure of the Monkey's whereabouts before he began to shave, for he feared his nerves might not stand a second shock of the same kind.

Monkeys seem to be able to communicate their ideas to other Monkeys very readily, and a few years ago, Professor Garnier made some interesting experiments to ascertain whether these animals have a language that could be made intelligible to human beings. He secured phonograph records of the "talk" of Monkeys in museums and zoölogical gardens, and then went to Africa, where he shut himself into a great cage of iron bars, in the forest, and reproduced on the phonograph the sounds previously recorded by the instrument from the chatter of Monkeys in captivity. The wild Monkeys, Professor Garnier says, listened and chattered in reply, and he claims to be entirely satisfied that they have a rudimentary language in which they talk to each other as we do.

Monkeys are always interesting creatures because of their smart, clever ways and their resemblance to human beings. They are very curious, and when allowed to run at large, pry into all sorts of things

which do not concern them. A great naturalist once put into the cage occupied by his Monkeys, some tin boxes containing poisonous snakes. He showed the Monkeys the contents of the boxes and then replaced the covers. The Monkeys knew perfectly well what the boxes contained and were afraid of the snakes, but they could not resist the temptation to open the boxes and peer in. They would then run about in an ecstasy of fear, but if the covers were again placed on the boxes they could not keep away, and would slip them off again and again, each time trembling with fright.

When we see trained Monkeys, riding on the backs of ponies at a circus, we wonder if they are not frightened, but it is not improbable that they are enjoying themselves, instead, for a Monkey will of his own accord jump on the back of a dog or of a pig and ride about with every manifestation of delight in such amusement.

### THE WART-HOG

THE Wart-Hog is found in Africa, and gets his name from peculiar warts or wens which grow upon his head and snout. He is a kind of wild boar, and has long, curved tusks, much larger than those of the wild boar found in other countries.

He is not so brave an animal as the wild boar, however, and will run away in preference to fighting. He rarely attacks men, unless forced to do so in self-defense.

When pursued, he will seek a hole in the ground, very likely the hole of some other animal, but instead of rushing in head foremost, he turns and backs into the hole, so that he may be ready to rush out, if he thinks it is wise to do so, without turning around in narrow quarters.

His long tusks, and the warts on his snout, give him a fierce look, though, as we see from his habits, he is not greatly to be feared.

### THE WILD BOAR

THE Wild Boar is a brave beast, and his splendid courage arouses the admiration even of the hunters who are pursuing him to take his life, while his fierceness makes him a dangerous animal to encounter at close quarters.

He is like a pig or hog, but has longer legs than the fat swine which we raise for pork, and can run more swiftly.

When he is young, his coat is a reddish brown, but as he grows older it becomes a grizzled gray, with black underneath.



He is armed with tusks three or four inches long, which protrude from his upper jaw, and with these he can inflict terrible wounds. He is hunted with dogs, and before he can be killed he usually succeeds in tearing open, and putting out of the fight, several of the dogs which fasten their hold upon him.

The Wild Boar is found in most European countries, and is represented by a near relation in India. He makes his home in the woods, near brooks and rivers, where he can occasionally go to take a mud-bath, which he enjoys as much as any pig does.

He feeds on chestnuts, acorns and roots, and also helps himself to the fruit and crops of the farmer, sometimes doing great mischief. He keeps within cover of the woods during the day and comes out to feed at night, and in some countries the farmers ring bells, blow horns and fire their guns at night, during the season when the crops are ripening, in order to frighten the Boar away from their fields.

Unless he is surprised when feeding, or has his young near by, he may not offer to attack man, but his temper is uncertain and he never shows cowardice, so that, at the slightest hint of being disturbed, he is ready to rush upon his enemies.

When we know that he does not hesitate to fight the fierce tiger, we can understand how brave he is; and he is as strong and powerful as he is brave. Sometimes he gets the better of even a tiger in a fight.

In India hunting the Wild Boar is a favorite sport. The hunters ride on horseback or on the backs of elephants. They attack him with long spears, and sometimes, when driven to bay, he will rush boldly upon the spear in a desperate effort to reach the hunter. At such times he often crushes a horse's leg in his powerful jaws, or rips open his shoulder with his terrible tusks.

In olden times, Boar-hunting was a favorite pastime in England and in France. Men called "beaters" were sent out to arouse the Boar from his haunts and then the dogs were let loose upon his track. The hunters followed, sometimes on horseback and sometimes on foot. When a savage Boar was thus hunted down and finally chose a thicket of bushes in which to make his last fight, the dogs would leap upon him, fastening their teeth in his hide and biting at his legs, while the hunters came nearer with their spears, ready to give him a fatal thrust. The Boar never failed to kill several of the dogs, and would then charge fiercely upon the nearest hunter, who needed to be cool-headed and courageous to withstand the animal's dangerous assault. The hunters were often seriously wounded, or even killed, in this barbarous sport.

When he chooses to run instead of standing his ground, the Boar can give both dogs and horses a long and hard chase.





FROM COL. CHI. ACAD. SCIENCES.

PECCARY.  
1/5 Life-size.

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From col. Chi. Acad. Sciences.  
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CANADIAN PORCUPINE.  
 $\frac{1}{4}$  Life-size.

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## THE COLLARED PECCARY

IN AMERICA we have no wild boars, such as are found in Europe and in India, but in their place we have the Peccary. He is really a small wild boar, however, and will fight as fiercely and as bravely as the famous old boars of Europe.

The Common or Collared Peccary is about eighteen inches in height; no larger than a young pig. His tusks are not curved, like those of the European boar, but have very sharp edges, and he uses them more for cutting than for tearing. In attacking a dog, for example, he depends upon a quick bite with his jaws more than upon a thrust or cut with his tusks.

The Peccary is found in Texas, and in Central and South America. He usually makes his home in a hollow log, and remains there during the day, coming out at night to look for roots and acorns, and to prey upon the farmer's crops.

The Peccary is a good swimmer, and as he is a wandering animal, moving from place to place to find new feeding-grounds, he often swims across wide rivers.

Peccaries travel in herds and when attacked will surround the hunter without hesitation. They charge upon his horse, whose legs they cut with their sharp tusks; and if the hunter is dismounted, he may be very glad to escape by climbing a tree.

Small though they are, they are dangerous animals to meet, for they will fight on the slightest provocation, and unlike nearly every other wild animal, they have no fear of guns; neither the flash nor the report frightens them.

The hog and the wild boar make a sound something like "woof! woof!" but the little Peccary utters a hoarse cry like that of a goat.

The flesh of this wild pig is not very palatable, and Peccaries are hunted mostly because of the mischief they do to crops.

## THE PORCUPINE

PERHAPS you have heard the quotation about the man whose —  
 "Each particular hair did stand on end  
 Like quills upon the fretful porcupine."

It is his bristling sharp quills, given to him as a means of defense, which make the Porcupine a hard object for other animals to attack.

Different species of this animal are found all over the world. The common Porcupine, of which we hear oftenest, is as large as a cat,



and has sharp claws and gnawing teeth like those of the squirrel and the rabbit. He lives in burrows which he digs in the ground, and comes out only at night in search of food. Roots, fruits and plants are his favorite diet, and he sometimes does more or less mischief to the vegetables in the farmer's fields and garden.

The sharp spines, or quills, with which the animal's body is covered, are several inches in length. The quills are very sharp, and by an action of his body the Porcupine can set them up on end as a protection to his body so that few animals care for a close encounter with him. A dog or even a lion, is likely after an attack on this animal to find his head stuck full of quills which have barbed points that work in deeper, and unless immediately removed, they may kill the creature that assailed the Porcupine.

When the Porcupine is going peaceably about his own business, the spines lie flat on his body, pointing toward the tail, and as the creature moves through the bushes, the quills make a peculiar rustling noise, which is at once recognized by other animals. When they hear this they are careful to give the Porcupine a wide berth.

In America, we have the Canadian Porcupine, a tree-climbing variety with long, thick fur all over its body, as well as the spines, or quills, on the tail and the upper parts.

The food of this Porcupine consists chiefly of the bark of young trees. He often strips the upper branches of a tree clean of bark, and as he repeats this many times on different trees, an entire forest where the Porcupine has his feeding-ground, may be seen leafless and blasted as if by fire.

The animal may be tamed, and will stay about the house, making friends with other household pets, but he resists any attempt to play too roughly with him and may fill the dog's head with spines by a switch of his tail, as a punishment for too great familiarity.

### THE EUROPEAN HEDGEHOG

THE Hedgehog is sometimes confounded with the Porcupine, but he is really a very different sort of animal, except that he has a similar weapon of defense in the form of spines. He is more nearly related to the moles than to the Porcupine.

The Hedgehog makes a nest of hay and leaves in some sheltered place, under a hedge for example. The first part of his name comes from this fact, and as he has a snout resembling that of a pig he is called a Hedgehog. The Hedgehog eats insects, worms, beetles, mice and small snakes.

He is not as dangerous a creature as the Porcupine, for he does not leave an enemy with a skin full of quills. He simply rolls himself up in a ball, and neither dog nor cat can do more than get well pricked when he tries to bite the prickly animal. No amount of prodding will induce the Hedgehog to unroll. When his enemy is tired of trying to get beyond the sharp points of the quills, and goes away, the Hedgehog calmly returns to all-fours and goes to look for another mouse. He may be kept in the house like the Porcupine and is a much more agreeable pet to have about.

### THE EUROPEAN WILD CAT

IT HAS been said that Puss, our familiar household friend, is a near relative of the Wild Cat, but the fierce little animal found in the forests and on the mountains of Europe and Scotland has a very different disposition from that of our quiet and good-natured pet, and most naturalists agree that the Egyptian cat is the ancestor of the familiar cat by our firesides.

The Wild Cat looks very much like a large "tiger" cat, as his fur is striped and spotted in the same way. His tail, however, is much shorter and is bushy, almost like that of the fox.

The Wild Cat walks through the forest with the same slow and stealthy tread as the domestic cat, and springs upon his prey in the same manner. He hunts chiefly at night, and catches mice, squirrels and rabbits. Sometimes he makes his way to the farmyard, and creates havoc among the fowls. Often he bites off and eats only the heads of the hens and chickens, leaving the bodies untouched, then perhaps, at his next visit, he will carry off a plump hen bodily. He is strong and fierce enough to attack larger animals, and will even kill sheep.

He does not like man, and cannot be tamed. His home is always in some dark nook or rocky cavern, far up on the mountain, or in the densest forest, and he shuns the haunts of men.

The skin of the Wild Cat has but little value, and his flesh is not good for food.

### THE AMERICAN WILD CAT

THE American Wild Cat is also known as the Bay Lynx. He is simply a small lynx, smaller and browner than the Canadian Lynx, but larger than the Wild Cat of Europe. Like all the Lynxes, he has a very short tail.



## THE CANADA LYNX

THE name Lynx is given to an animal of the cat tribe which is found in Canada and the northern parts of the United States, in Europe and in Africa.

The common Lynx of our own country is the Canada Lynx. He is about three feet in length, and has a short stub of a tail. He has long fur, gray in color, and his ears, which are his distinguishing feature, are long and tipped with a number of stiff hairs, which bristle up and give the animal a fierce appearance, when he is roused. He is, in fact, a fierce animal, and even in captivity gives an angry snarl when approached. If disturbed, he will spring upon a man, and may inflict serious wounds.

The Lynx is usually found in the wildest parts of the forest. During the day, he does not retire to a cave to sleep, but dozes, curled up on a ledge of rock, from which he can easily see any approaching danger.

This fierce cat catches rabbits, squirrels and birds, for his food. He is not over-particular as to what he eats, however, and will follow the more powerful puma through the forest, at a safe distance, waiting until the puma has killed an animal and made a meal, when he will devour such parts of the meat as the puma has left.

The Lynx does not run, but, arching his back like a cat, moves over the ground in leaps. Having lithe limbs and long white claws, he both swims and climbs readily. He often climbs a tree and settles quietly on a branch, until a bird alights near him, when, with one quick blow, he stuns the bird and then eats it, after partly stripping off the feathers.

He is quick and cunning, and hunters are seldom able to get near enough to shoot him. Sometimes, in the winter, when very hungry, he descends from the mountains, and preys upon the farmers' sheep or poultry.

In Africa the Lynx's coat is of a reddish color, from which he is given the name "Red Cat."

## THE OCELOT

OCELOT is the name given to an animal of the cat tribe, which is much like the northern Wild Cat. He lives in the warmer portions of the Americas, from the Rio Grande to Brazil.

The Ocelot has a skin of tawny yellow or reddish gray, outlined with black rings and stripes. He is heavier than the Wild Cat of the North, but is never as large as the leopard of Asia.





From col. Chi. Acad. Sciences.

CHICAGO COLORTYPE CO. CHIC. & NEW YORK.

AMERICAN OCELOT.  
1/5 Life-size.







He is a fierce creature, and cannot be tamed, no matter how long he may be kept in captivity. He is an expert climber and springs from trees upon the birds or small animals upon which he preys. He is a persistent foe of the South American monkeys, and lies in wait to catch them, as they spring from branch to branch.

Like all the cats, he is a graceful creature. His beautiful skin is much sought after as material for fashionable fur goods.

## THE PUMA

**I**N THE Western Hemisphere there are no animals of the cat tribe so large and dangerous as the lion of Africa and the tiger of India, but there are several species of smaller animals which resemble them in some degree. The largest of these animals found in North America is the Puma or "Mountain Lion." It does not range south of Mexico, but is found in many parts of the United States and Canada. It is also known as the Panther or "Painter," Jaguar, Cougar and Mexican Lion. All these names are applied in different parts of the continent to the same animal.

Mountain Lion is to us the most significant of all these names, for this fierce cat is oftenest found in the Rocky Mountains, and has a tawny skin, with white lips and dark tail tip, like those of the African Lion.

This animal is about six feet in length and one hundred and fifty pounds in weight, and though not as large as the African Lion, is nevertheless a strong and dangerous beast. He is not fond of fighting in the open, but hides in trees and will suddenly spring upon animals passing below. He rarely, if ever, attacks a man.

Although a Puma will follow a hunting or camping party for days, partly out of curiosity and partly in the hope of getting a chance to attack the horses, he does not usually attack them if the hunter shows that he is aware of the animal's presence. Hunger, however, makes the animal bold and fierce, and when he has been long without food, even the presence of a man will not keep him from killing an animal that he wishes to secure for his dinner.

Besides being a flesh-eater, and a hunter of other animals, the Puma likes fish, and, unlike some other cats, does not object to going into the water. He will enter a stream, and watching his opportunity, seize a fish with his sharp claws and retire to the bank of the stream to devour his prize at leisure.

The Puma has now disappeared from the eastern states, excepting perhaps in the Adirondacks, having retreated before man and



his gun; but in the Rocky Mountain region and in British Columbia and Mexico he still flourishes, and hunters tell exciting tales of encounters with the animal. Occasionally, a Puma descends to the settled country and attacks a herd of cattle. He can easily kill a cow or a pig, and the farmers are sometimes compelled to organize a "panthèr" hunt to save their stock from the ravages of these animals.

His skin, which is smooth and is covered with short hair like that of the lion, makes an interesting trophy for the hunter, though it is not especially valuable in the market.

### THE JAGUAR

THE Jaguar is to Central and South America what the puma, or mountain lion, is to the northern part of this Hemisphere. Although he resembles the puma in many of his habits, the two animals are deadly enemies, and fight fiercely with each other.

The Jaguar has most of the characteristics of the tiger and the leopard, and his coat is one of the most beautiful of those found on fur-bearing creatures. The color is dark yellow, or orange, with spots of black, and the Jaguar has a flattened head like that of the leopard. His powerful legs and jaws enable him to crush his prey in much the same way as the leopard does.

He is fond of water, and is usually to be found near the banks of streams, although he travels many miles from them in search of prey. He hunts in the dark, and while prowling through the jungle he roars and growls. His voice is a terrifying sound to the hunter who may be spending the night in the forest.

There are man-eating Jaguars, as there are man-eating tigers. This terrible cat no more hesitates to attack a man than he does to attack a horse or an ox.

It is not safe to spend the night in a South American forest without kindling several fires about the camp, for the Jaguar detects the scent of man and horses from a great distance, and will make a bold attack on a camp unless kept off by the bright light of camp-fires. The horses fear the Jaguar as much as they do the tiger and if one be in the neighborhood, will prance and neigh with terror. He in this way often gives the alarm to the sleeping hunter.

The soft and beautifully marked fur of the Jaguar makes a magnificent rug or robe, and for this reason the skin has considerable value.

## THE LEOPARD

THE Leopard is another member of the family of powerful cats which eats flesh. He is found in Asia and Africa. All have one feature in common, however,—their fur, whether its ground is yellow or orange, is spotted with dark brown or black rosettes, and sometimes a broad black stripe runs down the back to the tail.

A cave on a rocky hill is the Leopard's favorite home, but it must be near the jungle, where he can hunt for game; and near water, where he may go to lie in wait for other animals as they come to drink.

His body is six feet or more in length, and his head is flattened, like that of the South American jaguar, which resembles the Leopard in many ways.

Cunning and stealthy in his habits, crouching among the branches of trees, and stealing through the forest with cat-like tread, the Leopard is not a pleasant neighbor. His food is the flesh of any animal he is able to kill, and monkeys, small antelopes, goats, sheep, dogs and cattle all become his prey. Sometimes he kills and eats a man, and when he has become a "man-eater," he is more dangerous than ever, for he will be constantly on the alert to find human prey.

In the jungle, the hunter sometimes hears a peculiar hissing, which resembles the noise made by the sawing of wood. It is the sound uttered by the Leopard as he walks about in the forest.

Although he is generally so sly and cautious in his movements, the Leopard is not cowardly, and sometimes displays great boldness in attacking his prey. One of these animals has been known to approach a camp at night, and spring over the bodies of men lying asleep on the ground, in order to seize a goat tethered in the camp. The Leopard is an accomplished climber, and he sometimes carries a goat or a sheep into the branches of a tree, where he may eat it at his leisure. He is so much at home in trees that he is sometimes called the "tree-tiger."

In India is found the Cheetah, or Hunting Leopard, which can be tamed and trained to hunt other animals for his master. In earlier times, when men indulged in more cruel practices than they do now, these hunting Leopards were brought to Europe and used in hunting deer. The Cheetah's head was covered with a hood, so that he could not see, and he was then taken to the forest, where the hood was removed and he was set upon a deer and usually tore open its throat in a few seconds. But after a time, men became disgusted at the thought of using so sly and ferocious a creature in the chase, and



the practice was abandoned. The Rajahs, or native Princes, of India, however, still keep Cheetahs for use in killing wild game on the open plains.

The beautiful fur of the Leopard makes his skin valuable, and it is much sought after on that account. As in the case of the other flesh-eating animals, his flesh is not good for food. If captured when young, Leopards may be easily tamed, notwithstanding their natural fierceness. They are often seen in museums and menageries, and are among the most graceful of all the wild animals.

## HYENAS

THERE are three kinds of Hyenas, the Spotted, the Striped and the Brown. They are found in India and in Africa, and are among the most repulsive animals of which we know. They look something like a large wolf dressed in the skin of a member of the cat family, and have a sloping back which gives them an ungainly appearance.

The Hyenas have powerful jaws, and their teeth are somewhat like those of the dog, but much larger. They are flesh-eaters, and eat fresh or decayed meat with equal relish.

They are fierce and ravenous brutes, but so cowardly that they always prefer to steal their food rather than to fight for it. They sneak up to a village in the night and seize a sheep or a goat, or perhaps a calf, and drag it away. They will even enter the tents and houses of human beings, and with one sharp bite tear away the cheek of a person who is sleeping. They hesitate to attack an able-bodied man, but will spring upon an old and feeble person as they would upon a sheep or a goat.

The Hyenas' tastes in food are not nice, and they are especially hated as grave-robbers, for they will dig open graves and devour the bodies of the dead.

They utter long, mournful howls when prowling about in the night, and a troop of Hyenas will sometimes surround a camp and howl throughout the night. They are afraid of fire, like almost all wild animals, and will keep at a distance as long as they see the blaze.

The Hyenas' skins are very handsome. They are a tawny or orange color, striped or spotted with black, but owing to the fact that these animals feed upon carrion, their pelts have an offensive odor and are not valuable.

Hyenas are sneaks and bullies among animals, but can be tamed, and will even make friends with dogs, which are their natural enemies.

## THE WOLF

THE Wolf is very much like a large, fierce dog, and at a little distance you might easily believe him to be a rough-coated hound with pricked ears. He is a flesh-eating animal, and it is partly because nature has given him an appetite for chickens and lamb that he has succeeded in getting himself so thoroughly disliked. He is, in fact, a midnight prowler and raider, and will enter the farm-yard at night and kill and carry off a chicken, a young pig, or a lamb, without difficulty.

He is a swift and steady runner, and when pursued gives the best dogs and horses a long chase. When he is himself pursuing his prey, he becomes a terrible foe because of his determination and his apparent ability to run forever without stopping.

In most countries the Wolf is careful to avoid man at all times, but in some, such as Siberia, where they have not learned to fear firearms, they are dangerous even to man, when pressed by hunger.

The Wolf gives out a peculiar and pungent odor, not at all pleasant to the smell, and horses, which especially fear Wolves, catch their scent and begin to run wildly for safety long before the driver of the team understands the cause of the fright.

Stories of the terrible ferocity of Wolves come to us from Russia and Siberia, where these fierce creatures exist in great numbers. In one case, it is said, a company of ninety soldiers, sent out to exterminate a pack of Wolves that had been attacking travelers and killing farm animals, was surrounded by Wolves, and although hundreds of the fierce creatures were shot down, they were so bold and came on in such numbers that the soldiers were overcome, and all of them killed.

Wolves have been known in nearly all parts of the northern hemisphere, but they are gradually pushed back as a country becomes thickly settled, and hang about the borders of civilization, where they can prey upon domestic animals. They are as sly and cunning as the fox, and are so suspicious of traps that they can rarely be captured.

They are hunted with a fierce breed of dogs called Wolf-hounds, for the ordinary dog will not attack an animal which may kill him with one vicious bite. These dogs are large, powerful animals and are especially trained for Wolf hunting.

A young Wolf may be taken and brought up among dogs, and will behave fairly well for a time, yet, in the end he will show that he is a Wolf, after all, especially if he has a chance to kill sheep.

There are several varieties of the Wolf—called respectively White Wolf, Black Wolf, Red Wolf and Gray Wolf as their fur differs in



color in different localities. There are also many kinds of Wolf that differ in other ways as well as in color.

The Coyote is really a small Wolf found on the American prairies. He makes his home in a burrow in the ground, and usually appears only at night. As soon as darkness comes, he sneaks around a camp, in the hope of finding a chance to steal something to eat, and very often a circle of Coyotes will surround a camp and keep up a most dismal and provoking howl throughout the night. A rifle-shot sends them scattering with their tails between their legs, like frightened dogs, but after a while, they sneak back again.

The Coyote can feign death so naturally as to deceive even those who know his habits well, and suffers almost anything to be done to him in hope that the hunter will leave him for dead, when he will spring up and run away.

While the Coyote is not as savage as other Wolves, not so likely to attack a man, he is a very skillful thief. In the far West, he hangs about forts and villages, snapping up here a chicken and there a pig, and even feeding from the garbage, for he by no means is select in his tastes.

His fur is coarse and is of a yellowish-gray color and he has a bushy tail.

The Coyote is larger than the fox and he has the unpleasant odor common to the Wolf family.

## THE LION

THE name of "King of Beasts" has been given to the Lion because of his majestic appearance and his great strength.

It may be hard at first to realize that the Lion belongs to the same family as our domestic cat. He is very much like a cat on a large scale, being as tall as a good-sized calf. He has the same general form as the cat, though his mane makes his head look proportionately larger, and his body is catlike and graceful. His tongue is rough like the cat's. He has sharp claws, and his long teeth are very strong and sharp.

His coat is of a tawny color. He is so strong and agile that he can attack and overpower animals much larger than himself.

He creeps stealthily upon the animal he has selected for a meal, just as the cat creeps near a mouse or a bird, and pounces upon it with a single spring. He does the greater part of his hunting by night. If you have ever heard a Lion roar in the menagerie you can imagine what a terrifying noise it must be to other animals which





From col. Mr. F. Kaempfer.

BLACK WOLF.  
! ♀ Life-size.

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AFRICAN LION.

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hear it in the forest and know that the "King of Beasts" is in their neighborhood.

The Lion is found in Africa and in some few southern parts of Asia. He thrives only in hot climates, and if taken to cold countries, like our own, must be warmly housed in winter.

He is a flesh-eater and never eats grass or vegetables, but when wild game is scarce will steal up to a village and carry off a goat or a sheep. The Lion will not attack human beings by daylight, unless followed up and forced to fight, but in the night he becomes bolder and will spring upon a man, whose head he crushes with one bite of his powerful jaws.

The mother Lion is called a Lioness, and her cubs, when born, are about as large as half-grown cats. They soon become active and pretty little creatures, and play with each other much as kittens do. They may be kept quite tame for two or three years, but when the Lion has reached full growth, at the age of six or seven years, the only safe place for him is behind bars, no matter how good-natured he may seem to be.

The skin of the Lion makes a handsome rug, but the flesh is not good to eat, and the chief commercial value of the animal comes from the fact that he brings a good price when delivered alive to the owners of menageries, or the director of zoölogical parks, where he may be kept on exhibition.

There are men and women who make a business of taming and training Lions, and under their patient teaching these huge cats sometimes learn to do astonishing tricks. When we see one of these animals kept in a cage, however, we cannot but feel sorry for him, for in his native state, before he is brought from his home in the wilderness, he loves to prowl over a long reach of country, and will travel many miles in a single night. In his menagerie cage he paces restlessly back and forth, no doubt wishing he were back in the desert or forest, where he might enjoy the freedom for which nature intended him.

## THE TIGER

THE Tiger is even more like an enormous cat than is the lion, and is still more ferocious. He is found in Asia, principally in India, Siam and China. He lives in the jungle or thick forest, and usually spends the day-time in a cave or a den among the rocks, and does his hunting at night. If wild game is scarce in the jungle, he will approach a village in the hope of killing a cow or goat. A Tiger that has once killed and eaten a human being is called "a



man-eater," and is greatly feared by the people in the vicinity in which he has his haunts. It is said that a man-eating tiger that has once tasted human flesh prefers it to any other, and will take great risks to obtain it.

The Tiger is a large animal, and sometimes reaches a length of ten feet from his nose to the tip of his tail, and weighs from four hundred to five hundred pounds. His coat is a beautiful one, striped with orange-yellow and black, while the fur on his chest is white.

If you have an opportunity to see a living Tiger, you will notice that he has very large and powerful shoulders, as well as large sharp claws. He can thrust out and draw in his claws as a cat does. As these claws are strong and sharp, he is enabled to grasp his prey and hold it securely while he gives it a fatal bite. Tigers sharpen their claws by standing close to the trunk of a tree and drawing them rapidly through the bark. They seem to enjoy doing this, and it keeps their claws as sharp as razors.

The Tiger's eyes are very large. In the night they shine in the darkness like yellow lamps, and the animal, like the cat, can see nearly as well at night as in the daytime. In India, Tiger-hunting is a pastime. The hunters usually ride the backs of elephants and are thus able to go through jungle-grass and into places that would be inaccessible to a man on foot or on horseback.

Hunting the Tiger is dangerous sport, however, for the Tiger sometimes springs upon the elephant, and the hunter himself is in danger, unless he can succeed in shooting the savage animal. A plan that is sometimes followed is for the hunter to conceal himself in a tree, while natives, called "beaters," surround the Tiger's den, and with hideous noises frighten the animal from his retreat. As he moves along the path near which the hunter is concealed; he is shot before he suspects his danger. Tiger cubs, like baby lions, are amusing little creatures, and are as playful as kittens, but they grow strong very rapidly, and soon become rough in their play.

The Roman Emperors introduced Tigers into their gladiatorial sports, compelling men to fight these fierce animals in the open arena, with sword and shield for their only defense. Needless to say, many men were thus sacrificed to gratify the savage tastes of the spectators.

A Tiger's skin makes a very handsome rug, and has considerable value. The flesh is not used for food.

## THE RHINOCEROS

“**A**S TOUGH as Rhinoceros hide” is a common expression, and it means that the thing to which allusion is made is very strong and tough indeed.

Rhinoceroses are found in Africa and in India. In some ways they are like a very large wild boar, but, unlike the latter, they have at the end of their snouts a remarkable horn. The Rhinoceros found in India has only one horn, which is usually about fifteen inches in length, but the African Rhinoceros has two, one behind the other. The larger horn, which is in front, sometimes measures thirty-six inches in length, while the other is often only half as long. With these horns, the Rhinoceros is accustomed to tear up the earth as he walks along, and they are so strong that he makes the ground look as if it had been plowed.

The Rhinoceroses spend no time in running after men, unless men first run after them, and are disposed to go quietly about their own business, if not disturbed. Grass and tree branches being their staple food, they spend the night in feeding, and often wander many miles into the forest. In the morning they make their way back to the water, where they drink and splash about for some time, and then again retire to the forest, where they spend the day in sleep.

The hide of the Indian Rhinoceros, while it is thick and hangs in folds about his neck, is not remarkably tough until it has been taken from the animal and dried. Then it becomes very hard. In Africa the natives use the dried hide of the kind found there for making shields, and to those tribes whose battles are fought mostly with the bow and arrow and the assegai, or dart, these shields afford good protection, for the dried hide easily stops such missiles.

The African Rhinoceros has a feathered friend called the Rhinoceros Bird, which follows him about, perching upon his back and pecking the parasites from his hide. The great animal has but poor powers of sight, although his scent is keen, but the Rhinoceros birds are always on the lookout for the big fellow's foes, and if an enemy approaches, they rise in the air, screaming loudly, whereupon the Rhinoceros rushes off into the thickest of the forest, and in this way often escapes the hunter. Sometimes, however, instead of trying to escape, the Rhinoceros will turn and charge on the hunter, when, unless the latter can get out of his way, or the animal is shot down, he may kill his pursuer. He moves swiftly, in spite of his clumsy looking body and his short legs. He rushes viciously at his enemy, with his head held so that the long, sharp horn points straight at him.



Sometimes the Rhinoceros takes a notion to turn the tables on his pursuer. He forces the hunter to take refuge on a rock or in a tree, probably with his gun out of reach, if he had to run for his life. Then he waits patiently about the place, sometimes pretending to go away, but rushing back with head lowered for a charge, if the man shows signs of leaving his place of safety. He will, perhaps, rip the bark from the tree with his horn and dig out splinters of the wood, just to show what he could do if he tried. But he is such a dull animal, after all, that if some new object comes along and attracts his attention, he may forget all about the hunter in the tree and go off without giving him another thought.

The natives eat the flesh of the animal, but it would not be very appetizing to us, who are accustomed to beef and lamb.

## THE HIPPOPOTAMUS

THE Hippopotamus is an animal as large and unwieldy as his own name. He is found in Africa, and makes his home near riverbeds, for he is fond of water, and spends half his time in it. At night the Hippopotamus wanders along the banks of the river, feeding on grass and reeds, and sometimes he strikes off across country, but is sure to end his journey near water, before daybreak. He spends much of the daytime in swimming or floating lazily in a quiet pool, though he sometimes crawls out to bask on a sandy beach in the sun, or roll luxuriously in the oozy mud.

The Hippopotamus has an enormous mouth, and when he opens it to its full extent, it looks like a small cavern. His eyes and nostrils bulge out from his head, so that when he floats in the water only his forehead, eyes and nostrils, and the upper part of his back, can be seen. The rest of his body is submerged, and he might easily be mistaken for a floating log.

A large Hippopotamus is but little inferior in weight to an elephant, but his legs are so short that his size is not evident. He is naturally harmless, but with his mighty jaws, if made angry, he easily crushes in the side of the hunter's canoe.

Unless attacked, however, or disturbed while caring for his young, he is not disposed to interfere with man. He is not a very clever animal, and spends his time in what seems to us a very lazy fashion.

The flesh of the Hippopotamus has a mild flavor, and is very much prized by the natives of Africa. Sometimes the people of an entire village join in surrounding a herd of Hippopotami, kill them all, and then feast for several days on the meat.

Hippopotami live in family groups of four or five, and sometimes in herds of twenty-five or thirty.

They are hunted for their skins, from which leather is made, and in recent years they have been slaughtered in great numbers.

### THE ANT-EATERS

THE Ant-Eaters are found chiefly in South America, where they make their homes along the banks of streams. One species, called the Great Ant-Bear, attains the size of a small bear and has a body shaped much the same as Bruin's, but with the addition of a very long and bushy tail. The Little Ant-Eater, which does not grow to be as large as the Ant-Bear, unlike the larger animal is a tree climber.

These creatures live principally upon white ants, and nature, therefore, omitted to supply them with teeth. In South America ants are not the tiny creatures with which we are familiar, which throw up little mounds of brown earth, perhaps half an inch high, but are much larger, and build great ant-hills of clay, sometimes ten feet in height. Other animals do not disturb them, but the Ant-Eater tears the hill open with his strong claws and the ants immediately run out in great numbers to see who has disturbed their house. The Ant-Eater puts out his long, slender tongue, which is coated with a sticky solution, and in a moment it is covered with ants. He then draws in his tongue and thus obtains a mouthful of food. He repeats this operation several times until his hunger is satisfied. He has no teeth, but his tongue serves well to catch his prey.

In Africa is found the Ardvark, or Earth-Pig, which is also an Ant-Eater animal. He is shaped much like a pig, and has a long snout, and a long, slender, sticky tongue, like the Ant-Eater of South America. Unlike his American relative, however, he has teeth, and eats, not only ants, but other food also.

The Earth-Pig is about five feet in length. His home is in burrows in the ground. The flesh of this animal is said to have a fine flavor, and he is much sought after by hunters.

### THE NINE-BANDED ARMADILLO

THE Armadillos are ant-eating animals, though they are also fond of worms, caterpillars, lizards and snakes.

They range from five inches to three feet in length. They have usually a long snout and a long, tapering tail. Their most remarkable feature, however, is the coat of mail which covers the upper part



of their bodies. This is made up of a series of hard, bony scales or plates, which resist the teeth of much larger animals. When attacked they roll themselves up into a ball and thus defy many of their enemies, for they cannot bite through this bony shell. The Armadillos have no protecting shell underneath, however; the only cover there is hair, and if a dog or fox succeeds in turning them on their backs before they can roll into a ball, they are easily killed.

These little animals are found only in America, most of them in South America. One species only comes as far north as Texas, and that is the one shown in our picture. He makes his home on sandy plains or in fields near the woods, but never in the forest itself. He lives a more or less solitary life in a burrow in the ground, from which he comes only at night, or on dark cloudy days, for the light of the sun is disagreeable to him. As he is very fond of the ants, he sometimes makes his burrow directly under an ant-hill, so that his dinner may be always ready. He licks up the ants by hundreds, and their bites do not affect him at all.

The Armadillo is an expert digger, and he can in a few minutes make a burrow, even in the hardest earth, large enough to contain his body. Once in the burrow he cannot be pulled out by the tail, for he thrusts his long white claws into the ground and is strong enough to maintain his hold almost indefinitely. So his pursuer must dig him out. The native Indians are very fond of the flesh of the Armadillo, and some white people think it a palatable dish.

## THE GREAT KANGAROO

THE Kangaroo has a long body and a small head, and his hind legs are much longer and stronger than the fore legs. Perhaps his most distinct feature is his remarkable tail. This member is thicker than a man's arm and several feet in length. When he sits erect, he rests partly upon his strong hind legs, and partly upon his powerful tail. He has a smooth coat which is generally of a dark leaden gray or reddish brown on the back, and shades to a lighter color underneath.

Australia is the home of the Kangaroo, and so many thousands of these strange animals roamed about the island only a few years ago, that the sheep-raisers were forced to kill them off as fast as they could, in order to save the grass for their flocks; for the Kangaroo is a grass-eating animal and bites off the grass so close to the roots that he leaves nothing for other animals to graze upon. When he feeds, he stoops over and rests on his fore legs, while he nibbles the





FROM COL. F. M. WOODRUFF.

ARMADILLO.  
1/3 Life-size.

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grass. He moves over the ground, not by walking, but in a series of hops. When feeding, he pushes his long hind feet forward between his fore legs, and then, balancing himself by means of the heavy tail, which rests upon the ground, and is almost as useful as another leg and foot, he hops forward a few feet at a time, to reach fresh grass.

When alarmed, the Kangaroo makes great bounds, sometimes covering twenty feet in each leap, and does not touch the ground with his fore feet during his flight. The great tail not only helps to push him forward, but serves as a rudder by which he can direct his course.

Another remarkable feature of the Kangaroo is that the mother has in her breast a sack or pouch of loose skin in which she carries the baby Kangaroo for several months, until he is old enough and strong enough to take care of himself. If the little Kangaroo is playing in the grass and becomes frightened, he bounds back to his mother, and leaps head-foremost into the pouch. It is a very pretty sight to see the baby Kangaroo peeping from this retreat.

The Kangaroo is neither a fierce animal nor a very intelligent one. He always makes the greatest possible efforts to escape a pursuer, but if run down and forced to fight, he defends himself as best he can. This he often does successfully, except, of course, against the hunter's leaden bullets. With his short forearms, he will seize a dog, and squeeze him so tightly as to render his enemy helpless, and if he is near water, will hold the dog's head under water until he drowns. He sometimes seizes with his fore legs, an animal or a man, and then, bringing up one of his powerful hind feet, which is armed with a long, pointed nail, strikes a terrible blow, which is of sufficient force to kill a man.

The Australian farmers have suffered so much loss from the Kangaroo that they have slaughtered the animal in great numbers, but, though the Kangaroo has been driven away from the more thickly-settled parts of the country, he still exists in great numbers in the wilder wooded parts.

This queer animal is easily cared for in captivity. He is not especially sensitive to cold weather, and, if well cared for, will live many years. Kangaroo skins, when tanned, make excellent leather, which is used in making the softest of shoes and slippers.

There are many kinds of Kangaroos, but the others are much smaller than the Great Kangaroo and are in all ways less important.



## THE ELEPHANTS

WHAT would the circus or the menagerie be without Elephants? Why, a good deal like the Fourth of July without fireworks—something of a show, but with the best part lacking.

The Elephant is to many the most interesting of all the wild animals. He is the largest of those now living on the earth, and we have reason to think that he is one of the very, very great-grandchildren of the mastodon, an animal that lived here not so very long ago. The mastodon, like the Elephant, had tusks and a trunk, and was of great size. There are two distinct kinds of Elephants living to-day. The common Indian Elephant with small ears, and the larger African Elephant with enormous ears.

Formerly both were found in great numbers, but Englishmen who are fond of hunting big game have slaughtered so many for "fun," and the natives have killed so many to get their ivory tusks, that in Africa they are much more scarce than formerly, and in India the government has found it necessary to protect them by allowing them to be hunted only at intervals. In India, Elephants are trained and made useful in many ways, so that we have reason to hope that this interesting animal will not be allowed to become extinct, like the bison of our Western prairies, or the fast-disappearing zebra and giraffe of Africa.

Elephants sometimes live to be one hundred or more years of age. Their usual height is from eight to ten feet, although they have sometimes been known to reach a height of twelve feet. "Jumbo," the famous African Elephant that was kept in London for many years and then traveled in this country with a circus, was eleven feet in height, and weighed more than six tons. Think how easily an Elephant could crush a man, or even an ox, simply by stepping on him!

The Elephant's thick skin hangs loosely on his body. His great ears, which flap back and forth like fans, are in keeping with his huge body, but his eyes and tail seem absurdly small for so large a creature.

His trunk is one of his most valuable possessions. It is long enough to reach the ground when he stands erect, and is so flexible that he can move it in any direction. It serves him as a long nose and as an arm, also, for with it he can pick up very small bits of food, which he then thrusts into the oddly-shaped mouth, located behind his trunk. The Elephant can also fill his trunk with water and throw it into the air, so that it falls on him as a cooling shower; or if he is inclined to mischief, he can blow the water with considerable

force at any one near him. Protruding on either side of his trunk are the tusks, which are really two upper front teeth, which grow very large.

These tusks are sometimes from five to eight feet long and a pair of them weighs from one hundred and fifty to one hundred and seventy pounds. From them we get ivory for making billiard balls, chess-men, the sticks of fans and many other delicate and beautiful objects. These tusks, therefore, are valuable, and to get them men have slaughtered the Elephant without compunction. Nature gives the animal his tusks as a weapon, and as a tool with which to dig up roots. He eats grass and the tender branches of trees, but does not prey upon other animals.

Elephants will flee from the approach of man, for they are intelligent creatures and know that he is their worst enemy. Sometimes, however, there is a "rogue" Elephant,—a name applied to an Elephant of vicious temper, which goes about seeking to do mischief. A "rogue" will charge fiercely on a man who approaches him, and as he comes running forward, with his huge body swaying from side to side, he is a very dangerous enemy.

The Elephant likes to roll in the mud and to play in the water, but most of the time he is moving from one place to another, and he even sleeps standing. Elephants travel over great ranges of country, often going from twenty to fifty miles a day; and although they seem to be clumsy creatures, they move so swiftly, that if they have a little start the hunter will rarely be able to overtake them. One hunter tells how he followed the track of a herd of Elephants for four days, as fast as his horse could go, and only caught up with them because they made a long loop and crossed their own track.

In India, men capture Elephants by means of deep pits, which are covered with earth and leaves, spread on a thin support. The Elephants are enticed to these pits; and if they fall in, their feet are crowded together at the bottom, and they cannot get out. Another method of capture is to pursue them, on tame Elephants, and lasso them.

Once captured, the Elephant is easily tamed, and becomes a cheerful servant. He displays a good deal of affection for the master or keeper who cares well for him, but he is resentful of injury, and has a wonderful memory for those who do him harm.

Several years ago, a man watching an Elephant in a menagerie gave him a quid of tobacco. As other people were feeding him peanuts, candy and cake, the Elephant suspected no harm and put the tobacco into his mouth. The taste of the tobacco was very offensive to him, however, and he trumpeted with rage, refusing to take anything more that the spectators offered him. The man who had given him the tobacco laughed heartily, but the Elephant was very



angry. Some years afterward, this same Elephant was in another city, and the man who had given him the tobacco came near him. Although the animal had not seen the man for years, he remembered the tobacco, and, watching his opportunity, as the man leaned over the rope outside which the spectators stood, the Elephant suddenly seized him, dragged him under the rope, and then, raising him in the air with his trunk, threw him over the heads of the spectators against a tent-pole. The man was injured so that he was crippled for life, and probably the Elephant's owner would have thought he had become insane, as Elephants sometimes do, had not the keeper recognized the man as the one who had given the animal the tobacco years before.

A good-natured Elephant shows his liking for a person by fondling him with his trunk. The Elephant obeys his keeper's commands promptly, and this makes it possible to use him for doing very heavy work; as in India, where he is used in loading and unloading vessels, drawing great loads, and raising heavy weights. An Elephant easily handles with his trunk and tusks a log which a dozen men could not lift. His docility is shown by the fact that while he fears the tiger more than any other animal, he can be trained for use in hunting that fierce animal in the jungle. He carries the hunter in a box-like saddle called a "howdah," which is strapped to his back.

An Elephant is fully conscious of his own weight and of the danger in walking on thin supports. When he crosses a bridge, he tries it first with one foot and then with the other, and if he decides it is not strong enough to sustain his weight, no amount of coaxing or goading can persuade him to cross it.

As proof that he is a clever animal, we have only to watch his performances in the circus. When the largest and strongest animal in the world submits to being taught how to turn somersaults, to walk on a single row of pegs, to play see-saw, or to sit in a chair at table and ring a bell to call for his dinner, we must admit that he is entitled to great respect for his intelligence, as well as admiration for his good-natured obedience.

But Elephants are not always happy in captivity, and sometimes become very cross and unreasonable. When they get to this point, they are dangerous to the men who care for them, and sometimes are shot to prevent their doing mischief. One cross Elephant, which sulked and refused to move, had a chain placed about his neck and two obedient Elephants were given the task of drawing him to another room. The cross Elephant was so stubborn that while the others pulled on the chain, he deliberately hung back until he was suffocated, so that he really committed suicide.

If you look at the flag of the country of Siam, you will see that it bears a figure representing a white Elephant. In that country the white Elephant is held sacred, and if a man kills one, he is himself put to death. When a white Elephant is captured, he is taken to a temple, where he is cared for by priests and worshiped as a sacred animal. White Elephants are really of a dirty pink or pinkish-gray color,—a much lighter color than that of the ordinary slate-colored ones, but still very far from white. They are not a separate species but are “albinos,”—an occasional freak of nature.

## THE CAMEL

WE HAVE many things that are not possessed by the people of the far East. They, however, have one animal that we have not, and that is the camel, which is peculiarly valuable to them.

The Camel is no longer a wild animal, as one might think from seeing it in the menagerie along with the elephant and the kangaroo, but has been for centuries a beast of burden, in the deserts of Africa and Arabia. In fact, the Camel has come to be known as the “ship of the desert,” because it is only with his aid that the ocean of sand can be safely crossed. There he is to the desert traveler what the ship is to the mariner.

The Camel has two noticeable features—the hump which rises on his back and his long, ungainly neck. The hump is really a storehouse of fat, and when the Camel’s food supply is cut short, nature has arranged for him to draw for nourishment on this store of fat. So, when he has had little or no food for a long period, the hump disappears and the Camel’s back becomes almost flat.

In the same way nature enables him to keep on hand a supply of water to be used at will. The Camel has a wonderful stomach, like that of the cow, and one of the compartments of his stomach is composed of cells which he fills with water when he drinks. Then, if he is compelled to go for a long time without a fresh supply, he can draw upon this reservoir in his stomach, by opening the cells one by one and letting out a little water at a time. In this way he can take sufficient water for six days’ supply.

The Camel walks in a peculiar fashion, which causes his rider, who sits on the Camel’s hump, to sway back and forth with a rocking motion, that makes some people sick. Perhaps that is another reason why they call the Camel the “ship of the desert.” This swaying is due to his moving both the legs on one side forward at the same time. Look at an ordinary horse, and you will see that he moves



the right fore foot and the left hind foot forward at one time, and then the other two feet, so that he moves without swaying much.

Although the Camel's gait is so ungainly and so slow,—for he goes at the rate of only three miles an hour,—he can, if necessary, travel for twenty or thirty hours without stopping. In the desert, people sometimes have to go many miles over dreary wastes of burning sand before it is possible to reach an "oasis," as we call a little spot where there is grass, and perhaps a few trees and a spring of water. To cross the desert sometimes requires several days, and how would people be able to make the journey themselves, or to send their goods to be sold, if it were not for the Camel? By using horses, you say? Oh, no! for the horse can go only a few hours without food and water, and he cannot travel so far at one time as the Camel. Moreover, his feet would sink in the sand, while the Camel's feet are prevented from doing this by their ability to spread widely apart and rest on the two broad, soft pads on the bottom. These pads also serve to keep the sand from burning his feet. And then, in the desert there are terrible blinding sand-storms, which are suffocating to men and to most animals, unless they can protect their nostrils. The horse has no way of protecting his nostrils, and would breathe in the fine sand, but the Camel has a sort of trap door in his nostrils, and when one of these storms comes up, he simply closes this trap door and keeps the sand out.

The Camel's natural food is grass or leaves, but he will eat prickly bushes, dates, bread and, in fact, almost any vegetable thing that is offered him. He eats much as the cow does, and if you have an opportunity to observe a Camel, you will see that his jaws slide one upon the other, for, like the cow, he "chews the cud." The Camel gives milk, which the Arabs use as we do the cow's milk.

Though the Camel carries heavy loads, he always seems to do so unwillingly. When he kneels at the command of his master, to receive his burden, he grunts and complains. He is not an affectionate creature, and often bites at one who comes too near.

In Central Asia we find the Bactrian Camel, as he is called, which has two humps on his back, instead of one. This Camel is also very useful, for he is able to endure, not only the hot sands of the desert, but ice and snow as well.

The Dromedary is not an animal distinct from the Camel, but is a breed of Camel that has been very much improved. He is especially cultivated for his speed, and is to the Camel family what our race horses are to the horse family. All things considered, the Camel is one of the most useful of the animals, and, for many thousands of people, takes the place of both our horse and cow.

## THE ZEBRA

IF you can imagine how a small white pony would look if you striped him all over his body with a black or dark brown paint, and added long ears and a stiff, bristling mane, you will have some idea of the appearance of a Zebra. His legs are short and neatly formed, his hoofs small but very hard, and his teeth like those of the horse. His natural food is grass.

This little wild horse, for such he really is, is found in Africa. Formerly there were vast herds of Zebras, but so many have been killed, that it seems only a question of time when the last of them will have disappeared. When the Zebra is finally extinct, we shall have lost one of the most interesting and picturesque animals of Africa. The Zebra is shy and runs quickly from the hunter, but if forced to fight will turn bravely on his pursuers, for his temper is fierce, and with teeth and hoofs he can do considerable mischief to an enemy.

Zebras have been tamed and made to work in harness, but they are not strong enough to draw very heavy loads. They may be used to draw light carriages, however, and a pair of Zebras makes a pretty team. The animal's skin is sometimes tanned and used for leather, and the natives of Africa are very fond of the flesh, which has a sweet flavor. The lions are especially fond of it, and will lie in wait for hours near a stream where Zebras come to drink, in the hope of pouncing upon one of the animals.

There are several species of the Zebra, some of which are known by different names. All are much alike in form and are marked by the conspicuous dark stripes around the body and legs. One of these is called the Quagga, or Couagga. Formerly, vast herds of this animal were met with on the great plains of South Africa. Owing to the encroachment of European civilization, the Quagga, in common with most of the wild animals of that region, has almost disappeared, as have some of the primeval beasts of our own country. The Quagga closely resembles the horse in form. He is lithe and graceful, and in all respects a beautiful animal. He is fleet of foot, though smaller than the horse, and therefore not capable of as great speed.

The Quagga is favorite game for sportsmen. Gordon Cumming and other great hunters have told in books, very fascinating stories of their adventures with this roamer of the plains. His flesh is said to be palatable and wholesome. The Quagga is not easily domesticated, but this has been accomplished in some cases and he has even been trained to harness.



Perhaps the most beautiful of the Zebra family is called Burchell's Zebra, which belongs, strictly speaking, to the Quagga branch. His stripes are more distinctly marked than those of any other species and the animal presents to the eye a charmingly attractive appearance. In form and habit he does not differ from others of his class.

### THE GIRAFFE

AS THE elephant is the largest, so the Giraffe is the tallest of living land animals. When fully grown he is sometimes nineteen feet in height, or more than three times the height of a tall man. He is found only in Africa, and even there he is becoming rare, so steadily has he been hunted.

He is something like a deer with a very long neck, but, in place of the deer's antlers, he has two short horn-like projections which grow between his ears and are covered with hair. His back slopes from the withers, which are very high, to the rump, which is very low, conveying an impression that his hind legs are short,—which is not the case. This strange animal's skin is fawn or orange color, shading into white on the inner and lower parts of the legs, everywhere mottled with dark spots.

The Giraffe has a small head and large, lustrous eyes, which give him an appearance of peculiar gentleness and docility—and such, indeed, is his character. His eyes are capable of a certain degree of lateral projection, which enables him, without turning the head, to see in all directions. For this reason there are very few other animals so difficult of approach. He is exceedingly watchful, wary, and timid, and at any alarm speeds away with wonderful rapidity. He is a swift though very ungraceful runner, his shambling gait being due to the fact that he moves the fore and hind legs of the same side simultaneously. Although he puts his trust in his fleetness for safety, when brought to bay he will give battle, even to a lion. His weapons are his heels, which his long, powerful limbs enable him to use most effectively.

The Giraffe has a remarkable tongue, about a foot and a half long, with which he pulls down the branches of the tall acacia trees, the leaves and twigs of which make up the greater part of his food. He is accustomed to roam over wide stretches of country in his African home, and, when captured and kept in narrow quarters, he pines for the freedom of forest and plain. So he does not live long in captivity, and, as it becomes harder each year to obtain specimens, it is to be feared that the next generation may never have a chance to see one of these beautiful animals.

The Giraffe is hunted on horseback, and only with a sure, swift "mount" can the huntsman have any hope of success. From the start, it must be a race at top speed, for if the long-limbed beast has five minutes the start, he cannot be overtaken. At close quarters, the experienced hunter will carefully keep out of range of those dreaded heels. The skin of the Giraffe, which is very thick, makes an excellent quality of leather for certain uses, especially for making sandals. The flesh is pleasant to the taste and is highly prized as an article of food.

This animal is often called the Camelopard—a word that is formed by combining the names camel and leopard. He somewhat resembles the camel in his long neck, and his mottled skin is much like that of the leopard.

The Giraffe may be seen in almost every menagerie or zoölogical garden. He is a favorite with those who look with admiring eyes upon the beasts that roam the forests in foreign lands, and without him no collection of wild animals can be complete.

## THE LLAMA

THE Llama may be called the camel of South America. He is not as large or as strong as the camel of the old world, nor has he a hump on his back, but he is useful as a beast of burden, and resembles the camel in his ability to store water in his stomach and go for some time without drinking. Under his skin the Llama has a thick layer of fat, which corresponds to the fat in the hump of the camel. He is a native of the Andes, and is, therefore, suited to live on the mountain rather than on the burning sands of the desert.

His feet are divided into two toes, which help him to obtain sure footing on the rocky slopes of the mountains. When approached by an enemy, he spits out some of the contents of his stomach, which gives an offensive odor, a habit he has in common with the turkey buzzard. Llamas live in flocks, and in the wild state are very shy. Young ones are caught with the lasso, but the older and fleetier animals are not easily approached and must be killed with the rifle. There are really three species of the Llama family—the Guanaco, which is the Llama in a wild state, the Alpaca or Paco, and the Vicuña.

The Guanaco lives in the Andes, from Peru to Patagonia. In the northern part of this range, near the equator, he remains at a height of from six thousand to twelve thousand feet above the sea, where the climate is cold, even under the tropical sun. Farther south he ranges



on the plains. His upper lip is cleft, like that of the rabbit, to permit him to use his sharp, chisel-like teeth on hard vegetable growths. His tongue is long, and with it he is enabled to reach mosses and plants which grow in the narrow crevices of rocks.

The domesticated Llama resembles the wild Guanaco in size. He is over three feet high at the shoulder, and his head, which he carries erect, increases his height by two feet. The Guanaco's coat is of long, reddish-brown hair, but the Llama may be black, white or gray. Formerly, the Llama was the sole beast of burden among the mountains of Chile and Peru, but donkeys and mules are now used to a considerable extent.

The Llama can carry only a hundred or a hundred and fifty pounds burden, and can travel but twelve or fifteen miles a day, yet his sure-footedness makes him a valuable animal in the mountains. From his long hair the Indians make their clothing; they also use his dung for fuel and his flesh and milk for food. The Llama requires very little care, and may be allowed to wander at will during the day, for he will return to his inclosure at night, as cattle do.

The Alpaca is another species of Llama, and is usually found in flocks on the tablelands of the Andes of southern Peru and northern Bolivia, at an elevation of fifteen thousand feet above the sea-level.

In color, the coat of the Alpaca is usually gray, dark brown or black. The wool, which is of fine quality, varies in length from two to six inches, and is woven into the handsome and durable cloth of the same name.

The Vicuña is the smallest member of the family and is more like a sheep than like a camel, although he carries his head high. He is only two and a half feet high at the shoulder. His coat is reddish yellow on the back and whitish underneath. A domestic life is not to his taste, and he is not easily tamed. The hair is fine and soft and makes a heavy fleece, which has an outer covering of longer and coarser hairs. The wool from the animal provides the material for the beautiful Vicuña cloths.

Several attempts have been made to introduce the Llama as a domestic animal in the United States, but the climatic conditions seem to be unfavorable for him. He lives for a time on grain and pasturage, as do sheep and cattle, but he does not thrive long, unless he can get at vegetables, roots, mosses and lichens, similar to those found in the Andes.

## INTRODUCTION

*By FRANK ROE BATCHELDER*

BIRD life is apparently the essence of freedom. It is one of the brightest and most vivid elements of all nature. The blue vault overhead, which seems to bound the universe, is merely the elastic confines of dominion, where the little creatures reign supreme. Vast airy regions, which have never been subjugated by man, are the native element of the bird. His buoyant nature and feverish vitality lead him to expend his energies in a most prodigal manner; but the intense living and highly strung temperament tend to shorten his life, whereas the more phlegmatic animals live to a far greater age. With blood heated by a rapid circulation and quick breathing, the temperature of birds varies from  $100^{\circ}$  to  $120^{\circ}$ , while that of mammals ranges from  $98^{\circ}$  to  $100^{\circ}$ , and the normal heat of the cold-blooded reptiles is only  $40^{\circ}$ .

Birds are second in rank among the animals. They are of a lower order than the mammals, or animals which suckle their young, and higher in the scale of life than the reptiles, otherwise known as crawlers.

In classifying the birds, their power of flight would at first seem a distinction which separates them from other animals. But the bat belongs to the mammals, and he also flies through the air. The fact that the bird lays eggs is another feature often supposed to belong solely to this phase of animal life, but reptiles also claim this distinction. Snakes and turtles lay eggs, so also do two or three other animals,—for example the duckbill of Australia, about which one may read on page 47 of this book.

What characteristic of structure, then, is peculiar to the bird? He is the only animal with feathers. This fairy vesture resists the cold of winter and protects against the summer heat. A feather is a wonderful creation. Examine one carefully and see how delicate are its filaments. Some are brilliant as a rainbow, while others are graceful and artistic in their way as a flower. Feathers are growths of the skin, bearing the same relation to the bird that the fur does to the bear or scales to the snake. Thus we may say, in describing the bird as a distinct class in animal life, that it is an animal with feathers, or that any animal with feathers is a bird.

There is another characteristic in which birds differ from other animals. The mammals and reptiles have teeth, but birds have none. Ages ago, when birds more nearly resembled the reptiles than they do now, they were supplied with teeth, but no trace of that characteristic is now found among them, except that a few species have bills with edges like the teeth of a saw.

There are three ways in which we may consider the birds and their relation to ourselves. The first is scientific, treating of their relative rank



in the animal kingdom, and analyzing their characteristics of form and motion, and their relation to each other. The second consideration is economic, dealing with their uses. We have no trouble in understanding the purpose of a wise Creator in placing birds among animals, when we see how useful they are to us in devouring millions of harmful insects, the seeds of injurious plants and many small animals which damage crops. Moreover, birds like the Gull and Vulture, are scavengers, and consume decaying flesh and vegetable matter which might breed pestilence and death, were it not removed.

The third aspect of the bird is the purely sentimental. Their songs fill the world with music, while their grace and sprightliness captivate the bird lover even more than their brilliant, varied plumage, which enlivens the landscape like animated blossoms floating on invisible stems. Little bird lovers woo little lady loves with sweetest music full of tender meaning. Little bird housewives build their nests with many chirps of anxious consultation with diminutive mates. Little mothers brood over their eggs in quiet happiness, and flutter about their young with a pretty maternal solicitude. They are winsome creatures, these birds, and in some aspects are almost human. All the waving branches of forest and woodland form a leafy canopy to shelter tiny homesteads, where bonny songsters are born and reared.

The study of birds and their characteristics! What a vast realm it opens up before us. How diverse and beautiful nature appears in this one phase alone. Herein we find all the human passions, and many, too, which find their origin above. For all the good in human nature finds its source in the All-Father. And what a diversity of crafts our little feathered brethren are impelled to follow. Life is not all song, for birds as well as men must needs take serious views of life. A systematic study of our feathered friends is valuable to old and young alike.

There are so many different species of known birds—ten thousand or more—that we cannot learn the forms and habits of all, for even if we were to travel throughout every zone, and study one new bird each day, it would take us thirty years to complete the task. That must be left for the ornithologists—people who devote their lives to the study of birds, and have no other pursuit. But every one may study the birds of his own neighborhood, and it is more than probable that whoever undertakes to do so will find that in his own locality, many birds are “common,” which he has never seen, or noticed, simply because he has never used his eyes and ears to the best advantage.

But let us see how we may take up the study of birds in a practical way. We must remember that while all birds have much the same form and characteristics, in their habits one differs as widely from the other as do various races of men.

Thus, nearly all birds make nests, but some build on the ground, while others select hollow trees, and many nest in the branches.

Some spend the greater part of their time on the ground, like the Grouse and the Rails. Others live in trees—for example, the Flycatchers

and the Parrots, while the Humming-birds seem to spend their little lives on the wing, as do the Gulls and many other birds.

The Domestic Fowls scratch the earth to find food; Woodpeckers prey upon the insects that live in the bark of trees; Hawks catch fish in the water or small animals on the land; Swallows feed upon insects, which they catch while on the wing.

So there are Perching Birds, Birds of Prey, Poultry, Shore Birds, Running Birds, Wading Birds, Swimming Birds, Diving Birds, etc.

Before we undertake to study the habits of birds, it would be well to note their characteristics of structure. The outer features are the wings, the tail, the feet and the bill.

The wings are chiefly instrumental in the power of flight. Their concave or curved form aids in sustaining the weight of the bird in the air, and the entire structure of these organs adapts them in a wonderful way to their purpose. In order that the bird which soars to lofty heights may sustain his own weight with the least exertion, nature has made his bones hollow. When he rises in flight, the bones fill with hot air, which helps to buoy up his body. Some birds are provided with air-sacs within their bodies, which they inflate when flying, on the principle of a balloon. But the power of flight is developed more in some birds than in others. The Albatross, whose outspread wings measure fourteen feet, from tip to tip, can remain in the air for hours or even days at a time, without alighting. The eagle soars aloft to great heights and floats without apparent effort, watching his prey. But there are other birds which can fly but short distances, and never rise far above the ground. The Great Auk, a bird now extinct, used his wings so little, that in time they became mere stubs. And the Penguin's wings are too small for flight, though they serve as paddles in the water. The domestic Hen makes a very noisy and fussy piece of work of a short flight. It is all she can do to fly over the fence into the next yard. Birds which spend most of their time upon the ground, like the Rail, are not expert on the wing. But nature makes up for their defects in that respect by making them swift runners. The Ostrich is the most conspicuous example of a bird which never flies; yet he can outrun a horse.

Some birds use their wings to produce music, or to express their pleasure. As example, hear the "drumming" of the Grouse and the whistling sound made by the Woodcock with his wings. In most birds the wings are so vitalized with energy, that they respond to every emotion of pleasure or excitement. The flutter of little wings is part of the bird language. With the Mocking Bird, this pantomime is always an accompaniment to his song.

The wings are sometimes used as weapons. The Goose can strike a hard blow with his wing, and, in some species of Geese, there is a horny tip at the end of the wing, which makes the blow more effective. The Eagle uses his wing in the same way, to stun or disable the Fishhawk from whom he wishes to steal a fish.

The bird's tail serves commonly as a rudder to direct his course when flying. Birds that have short tails usually fly in a straight course, but the



long-tailed birds twist and turn at all angles, with the greatest ease. The Woodpecker uses his tail as a prop, while he is clinging to the trunk of a tree; and to all perching birds the tail serves as a balance. Birds express pleasure or excitement with their tails, just as they do with their wings. You have seen the Turkey spread his tail when he desires to "show off." The Peacock displays his vanity in the same way, and, during the mating season, other birds, like the Grouse, spread the tail to excite the admiration of the females, and you will notice that the Canary bobs his tail up and down while trilling a lively song. When a bird is unhappy or "out of sorts," his tail droops. The tails of different birds present a great variety of shapes. Some are short and rounded, while others are wedge-shaped and many are forked. The short upright tail of the Sora Rail is a striking contrast to the long, forked tail of the Scissors-Tailed Flycatchers. Many birds have tail-feathers which extend in gracefully drooping plumes, or waving sprays, delicate as the finest gossamer. The Egret, the Ostrich and the Bird of Paradise belong to this class.

With the exception of the man and the monkey, whose fore limbs are arms, the mammals have four legs. Birds have wings instead of fore limbs, so that they possess but two legs. Thus we see a gradual descent in the scale of animal life, from the mammals to the reptiles, which have very short legs, or none at all. If a casual observer saw a bird's leg, which had been severed from the body, he might be unable to name the species to which the bird belonged, while a scientist would at once recognize the species by the structure of the severed limb.

The legs and toes are an important part of the bird's structure, even in those birds which spend most of their time on the wing. Swallows and Swifts are examples of the birds with small legs and feet. They seldom perch on trees and use their legs very little.

Most birds have four toes; usually there are three in front and one behind. The Parrots and Woodpeckers, however, have two in front and two behind, so arranged that they can secure a firm hold on their perches. There are Parrots which sleep with their heads hanging downward; they hold to the perch by interlocking their toes in a firm grasp. The Owls have two toes in front, one behind, and one which may be used either in front or behind, at will. As a rule, birds with only three toes have them all in front, although the Three-Toed Woodpecker has two in front and one behind. The Plovers have three toes, all in front, while the Domestic Fowl has three in front and a very short one, which is of little use, behind.

The Ostrich, having no power of flight, is provided with long, stout legs, which enable him to run very fast. If brought to bay, an Ostrich can kick hard enough to knock a man down, and then can trample him to death. The Cranes and Herons are provided with long, slender legs—long, so that they may wade in deep water, and slender, in order that they may not overweight the bird when it rises in flight. It is noticeable that the length of a wading bird's neck usually corresponds to his length of legs. Accordingly, the Heron and the Flamingo have long, supple necks.

Rails and Snipe have long legs, in proportion to their size of body, in order that they may run swiftly through the reeds and over neighboring ground, where they make their home. The Parrot uses his foot as a hand, to carry things to his mouth, or in climbing, and the birds of prey have claws which curve inward and serve them in seizing their prey. The swimming-birds, like the Duck, are provided with webbed toes, which make of the foot a broad paddle. The birds of the farmyard use their strong feet in scratching the ground to discover their food.

A bird may do without much use of its wings, like the Fowl, or without much use of its feet, like the Swallow, but to every bird the bill is all-important. It is used from the earliest stage of his life, when the young bird in the shell breaks his way into the outer world, until the bird dies. Its uses are so various, that it would be a difficult matter to enumerate them all. The most important, of course, is in seizing and picking up food, and the bird's bill is proportioned to the use for which it was intended, according to the degree of difficulty in reaching his food. So the insect-eaters, which snap at their prey on the wing, need only short bills, but the Woodcock, probing in the earth for his food, has a long, slender one, and he has the power of moving the end of the upper mandible after his bill has entered the earth, which enables him to grasp the worm with greater ease. Ordinarily, a bird's upper mandible is rigid, while the lower one moves freely. In the Parrot, the reverse of this is true. You will find the nostrils of a bird in his upper mandible, sometimes as conspicuous as those of the Duck, whereas in other birds they are hidden near the base of the bill. The Barn Swallow uses his bill as a mason's trowel, to plaster mud on his nest; the Woodpecker uses his as an auger, to bore holes, and as a chisel, to cut away wood; that of the Oriole serves as a needle, to sew together the fibers of his nest, while the Pelican has a bag attached to the lower half of his bill, in which to carry fish. The Woodpecker uses his bill as a drumstick, in making the tapping sound that is so pleasing to his ear. This little instrument is an important factor in the toilet of all birds, for it is his comb, brush and oiler. My lady's powder puff and various cosmetics are not more precious in her sight than the little oil gland on the tail of the bird. By pressing this little receptacle with his bill, he obtains oil to rub on his feathers, and with his bill he preens and caresses into perfect order.

The plumage of birds varies according to their habits and the seasons. Birds which live upon the ground are usually clothed in colors that render them like the ground, otherwise they would fall an easy prey to hunters. Those which live among flowers or in the foliage of trees have more brilliant colors. All birds have a nesting plumage. In the chicken it is a suit of down; Robins are born almost naked. Usually, only male birds wear extremely brilliant coats, and their fine colors are put on just before the nesting season begins. When that period is over, the male bird often doffs his brave attire for a more sober coat, like that of his mate. This change of plumage is brought about by the molting or shedding of feathers. This process is gradual, only one or two feathers dropping out



at a time, while new ones almost immediately take their place. In the course of a few weeks, the old feathers have been entirely replaced by new ones. Food and climate affect the colors of the bird's plumage. Red pepper mixed with the food of a Canary will impart a reddish color to his feathers, and birds often wear white plumage in cold regions where snow prevails, while in warmer countries those of the same species have darker coats.

The migration of birds is one of the most interesting of their habits. Here, in the temperate zone, nearly all the birds with which we are familiar are migratory, that is, they move from place to place according to the season. We have some birds which remain with us the year round, like the Grouse and the English Sparrow. Then we have the summer residents, which come from the South in the spring to nest and rear their young and fly South again when winter approaches. Others, which we call winter residents, have their homes in the far North and come to us only in winter. Then there are still others, whose summer home is in the far North and whose winter home is in the South; they stop briefly with us only while passing from one latitude to the other. The instinct which prompts birds to seek favorable climates as the seasons change can never cease to be a source of wonder. For the most part, their moving is prompted not by fear of heat or cold, but rather by the fact that the change of season cuts off their supply of food, and the desire to have ample rations close at hand during the nesting period. Some travel by day and others by night; some in small groups, and others in great flocks; but all alike seem moved by the instinct to seek a new abiding-place.

Birds mate and nest at the earliest time of the year, when their food is abundant, so that while they are obliged to remain on or near the nest, they may not be forced to seek food at a distance.

In selecting a site for his nest, the bird considers whether it is safeguarded against enemies, as well as near an abundant food supply. Thus, in the case of the Woodcock, whose plumage resembles the dead leaves, the nest is placed where the setting blends so perfectly with its surroundings as to escape notice. On the other hand, the conspicuous nest of the Oriole is hung on the topmost bough of a tall tree, out of the reach of cats and other climbing animals. Think of the wonderful instinct that teaches the Weaver-bird to build his nest with the opening at the bottom, so that snakes cannot enter, and to shelter his dwelling with a stout thatch, like an umbrella. Think, too, of the laziness of the English Sparrow, who would prefer to drive another bird from his nest and occupy it, rather than build one for himself. Many of the sea birds build no nests, but lay their eggs in hollows of the rocks, in places so difficult of access that they do not fear being disturbed by enemies.

The European Cuckoo and the American Cowbird lack the home-loving instinct of other birds, and refuse to build nests of their own. Their natural depravity leads them to lay their eggs in the nests of other birds, in order that they may escape the responsibility of rearing their young. Birds differ in temperament, and some prefer to nest in seclusion, while

others, more social in their disposition, build their nests in colonies, like the Herons and the Weaver-birds. Some birds return to the same nest year after year, repairing it each season. The Eagle does this; but the Wax-wing is the very opposite in regard to attachment for places. Sometimes he does not nest even in the same neighborhood for two years in succession.

The number of eggs a bird lays is called by ornithologists a "clutch," and varies from one to twenty-five. In many cases, the mother bird performs the entire work of hatching the eggs; in others, she is assisted to some extent by the male. Nearly all birds care for their young very tenderly, and keep them well supplied with food. In many cases the food is first swallowed and partially digested by the parent, who then pumps it down the throat of the young bird in the nest. In the work of providing the food, the male often takes an important part.

Nearly all birds have "call-notes"—a bird language by which they communicate with one another. Many of these notes, however, have little or no music in them, and some are harsh and discordant.

Though the sweet songsters are few compared to the great number of birds of all kinds, there are many of these delightful little creatures, nature's musicians, who cheer the world with their joyous songs.

The musical faculty is the special gift of the male bird, and is rarely well developed in the female. During the nesting season, he usually sings his best songs, as though to cheer his mate while she sits upon the eggs.

The gift of song in birds is frequently accompanied by plain or dull plumage, though the Scarlet Tanager is remarkable alike for the beauty of his coat and the melody of his song. The little ruby-throated Hummingbird, the most exquisitely hued of all our familiar wild birds, utters a little squeaking sound that is scarcely entitled to the name of song.

Although many attempts have been made to note down bird songs, none of them have been successful. Our musical notation is capable of expressing sounds of definite time and pitch, but it cannot reproduce the gurgling sounds of running water, the delicate inflections of the speaking voice, nor the warbling music of bird songs. It is possible to give a good imitation of some of them with whistles, and the violin is capable of expressing certain of the most beautiful inflections of our feathered songsters. To attempt to get any intelligent idea of a bird's song from any form of musical notation is hopeless. We must go and listen to the song again and again, until it is as familiar to our ear as the voice of a friend.

One will never realize how much pleasure comes from an intimate knowledge of birds and their ways, until he is able at sight, or by their notes, to distinguish the species by name. This intimacy with the birds of one's own neighborhood seems to give him a passport into the whole society of birds, wherever he may go.

It is not a difficult thing to learn to know these feathered creatures well, though the study of their forms and habits requires both patience and application.



How may you begin? The first thing to do is to open your eyes. Stop a minute, and think how many birds you know by sight, the Robin and the Sparrow and the Oriole and the Crow—and—and—well, you forget the others! Yes, because you have not used your eyes. The birds were about you all the time, perhaps fifty different kinds.

The best place to study birds is in some locality where there is a meadow, water and a wood near each other, for in such a place you will see more species than in a wood alone or by the water only.

Provide yourself with a good field-glass or opera-glass, but do not take a gun. It is the living birds that are interesting; a dead one is a sad sight. A practical photographer will be able to make pictures of living birds in their native haunts. Such pictures have a commercial as well as a scientific value. But unless one understands a great deal about lenses, it would be well to leave the photography of birds to experts. Wear clothing of a dull color, following the example of the female birds, and make yourself as inconspicuous as possible. An artist's small camp-stool—the three-legged kind that folds into a small bundle—is desirable, for success demands that you shall remain in one place, and keep still, for a considerable time. You should move slowly, as hasty motions alarm the birds, whose eyesight is very keen. They are watching you all the time, even when you least suspect it.

The best time of day to pursue this study is from sunrise to ten o'clock; and again just before sunset. In the middle of the day, the birds keep under cover. In the winter, of course, the reverse is true, and from nine or ten to two o'clock is the best time to watch for them.

When you sight a bird, follow its flight with the glass, and while it remains in view note its size as compared with your Canary or the English Sparrow; observe its coloring, the size and shape of the bill and feet, and listen for its call-note. Try to imitate the note you hear. Birds are thus often rendered less afraid, and their curiosity prompts them to approach a person who can mimic their own notes well. When your bird flies away, out with notebook and pencil, and jot down your observations; it is so easy to forget. You must be persistent. Go again and again to the same place, watch for the same bird and add to the notes previously made. If you have access to colored plates of birds, like those in this work, or to stuffed specimens in museums, go with your notebook and try to identify the bird you have seen. It may be difficult for a time, as birds vary greatly in plumage—but in your second season, you will find it easy to recognize old friends.

When you find a bird's nest, do not touch it or disturb the eggs. A bird always knows when its nest has been disturbed and in such cases commonly abandons it, doubtless in great sorrow and alarm to think its retreat has been discovered.

Begin your study in the spring, when the birds first appear and watch for their southward flight in the fall. In the meantime, you will be able to learn many interesting things concerning them. From year to year, you will revise your notes and add to your fund of knowledge, and you will be satisfied that you could not find better employment for your leisure hours.

## BIRDS

THE Birds are classified as follows:—

### AVES OR BIRDS.

1. **Passeres or Perching Birds.**

The Fly-catchers, Crows, Jays, Orioles, Blackbirds, Finches, Sparrows, Swallows, Warblers, Thrushes, Robins, Bluebirds.

2. **Macrochires.** Those in which the first or outer joint of the wing is longer in comparison with the inner joint.

Night-hawk, Whip-poor-will, Chimney-swifts, Humming-birds.

3. **Pici.** Those which pick the wood of trees for food and for nest building. Woodpeckers, Yellow-hammer or Flicker, Red-headed Woodpecker, Sapsucker.

4. **Coccyges.** Those which resemble the Cuckoo.

Parrots, Parrakeet, Cuckoos, Kingfishers.

5. **Raptores.** Robbers, Plunderers, or Birds of Prey.

Vultures, Turkey-buzzards, Hawks, Eagles, Owls.

6. **Columbæ.** Those which resemble Doves.

Pigeons, Doves.

7. **Gallinæ.** Those which resemble the Common Fowl.

Quail, Pheasants, Grouse, Turkeys.

8. **Limicolæ.** The wading birds whose young run about at birth.

Snipe, Sandpipers, Plover.

9. **Paludicolæ.** Those which live in and near marshes.

Cranes, Rails, Coots.

10. **Herodines.** Those which resemble the Herons.

Hérons, Bitterns.

11. **Lamellirostres.** Those which have bills composed of thin plates, like leaves of a book.

Ducks, Geese, Swans.



12. **Steganopodes.** Those which have all four toes webbed.  
Cormorants, Pelicans.
13. **Longipennes.** Long-winged swimming birds.  
Gulls, Terns, Petrels, Albatross.
14. **Pygopodes.** Swimming-birds with legs set very far back.  
Loons, Grebes, Auks
15. **Ratitæ.** Those birds whose breastbone is not provided with a projection or keel, but is flat; not shaped like a boat but like a raft. (Latin, *ratis*, a raft.)  
Ostrich, Rhea.

## BIRDS

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### THE DOMESTIC FOWL

THERE are scores of different breeds of the Domestic Fowl which are classified according to the countries in which they originated.

In the American class are the Plymouth Rocks, Wyandottes, Javas and Dominiques. The Hens of these classes are good layers and patient sitters. The Mediterranean class includes the Leghorns, Minorcas, Black Spanish and others; these are small, active birds which lay well, but as a rule are not good sitters. The Asiatic class includes the Brahmas, Cochins, Shanghai and Langshan, which are the largest of all classes. These varieties do not lay many eggs, and are chiefly valuable as meat-producers. These birds have feathers on their legs, which give them a rather comical appearance, as they look much like baggy trousers about their feet.

Then there are Polish, Hamburg, French, English, and Game Fowls. All have their individual characteristics, and their feathers present a great variety of colors and markings.

We trace all the different breeds of these Fowls back to the Jungle Fowl, of Asia, where he is still found in a wild state. In very early times this bird was domesticated and made to serve the use of man. The Egyptians, the Romans, and the Greeks, made good use of the Fowl, and because of the fighting qualities of the Cock or Rooster, he was held sacred to Mars, the Roman God of War.

Of the different classes of domestic poultry, the common fowl, alone, has no distinctive English name. The feminine term "hen," and the masculine term "cock" are, however, usually supposed to designate the common fowl, unless otherwise qualified, as when the "turkey-hen" or the "pea-cock" is spoken of; just as eggs are always assumed to be hen's eggs, and not those of the turkey or of the goose.

Of the genus *Gallus*, to which the common fowl belongs, four wild species are known, the Bankiva Jungle fowl, the Sonnerat Jungle fowl, the Ceylon Jungle fowl, and the Forked-tail Jungle fowl. Darwin and other naturalists ascribe the origin of the domesticated breeds to the Bankiva fowl.

The Game Fowl has been brought to perfection in England, where from very early times, it has been bred for sport and for the table, its pugnacious career being no barrier to its edibility. The breast meat is always abundant, owing to the development of the pectoral



muscles. The characteristics of the Game Fowl are a single comb a massive beak, strong, sharp spurs, and sometimes plumage which is called "henney," the cocks assuming the plumage of the hen, but without losing their masculine combativeness. Even the hens of the game-fowl breed are pugnacious, being able to hold their own in the game pit as well as the cocks.

The Malayan fowl was the largest breed known in Europe, until the arrival of the lordly Cochins from China. The characteristics of the Malayan species are scant plumage, and very long legs and neck. The gray Chittagongs of the United States belong to this species. The interesting family of the Cochins, next in size to Malays, comprises several varieties, including Brahmas, Langshans, and the well-known majestic Plymouth Rocks. All these varieties are of large size, sometimes attaining a weight of sixteen or seventeen pounds.

All of them have small wings and tails, and abundant downy plumage. The Cochins, which came originally from Shanghai, and were crossed with the Chittagongs, produced the Brahmas, a well-defined breed which has never lost the original character of the crossing. The cross between the Cochin and a cuckoo-colored breed called Dominiques, produced the Plymouth Rocks. A stately Plymouth Rock rooster imparts dignity to any barnyard. Each feather of a fowl of this breed is marked with transverse gray stripes on a lighter ground. The cocks are of the same color as the hens, a characteristic of the Cuckoo family. The hens are famous layers.

The Hamburg family of fowls are smaller in size, have double combs, and small white ear-lobes. Spangled Hamburgs have feathers marked with transverse bands of black on a white or bay ground. This family is of English origin. It is highly prized for the remarkable laying qualities of the hens.

The Spanish breed includes Leghorns, Andalusians and black Minorcas. They have large, single, erect combs and white ear-lobes developed in the black Spanish type to such an extent that the whole face is white. Leghorns are chiefly white and brown in color. All the fowls of this breed are averse to sitting on eggs, owing to their having been bred for fertile laying.

Crested fowls, erroneously known in Great Britain as Polish, are so called because of their full-feathered crest. The comb is very small, or altogether lacking. In some breeds the wattles are replaced by a large tuft of feathers called a "beard." In color they are spangled, with a dark mark at the end of each feather. When the mark assumes a crescent shape running up both sides of the feather, the feathers are termed "laced." Another variety is entirely black with a white crest, and pendent wattles. Closely related to the crested, or Polish breed,









FROM COL. FRED KAEMPFER.

WILD TURKEY.  
1/5 Life-size.

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is the Crève-Coeur, which is all black, and remarkable for its laying qualities. Breeds also related to the Polish, but without the crest, are the Bredas, Guelders and the La Flèche breed, the best in France for eating.

The Dorking breed belongs chiefly to the south of England, where the fowls are raised in great numbers for the London markets. They are delicious for the table. The Dorkings have always an extra toe; those of Surrey and Sussex counties being four-toed. They are often crossed with game fowls to produce a hardier bird, and one of the highest excellence for the table.

Silk fowls have dark, bluish skins, dark, leaden-blue wattles and comb, and loose, strange-looking plumage, the barbs of the feathers not being connected by barbules. This bird is a faithful sitter and mother. Its flesh, when cooked for the table, is of excellent edible quality. Other peculiar breeds of fowls are the Frizzled, so called, because the feathers curl away from the body; the Rumpless, having no tail; the Scotch Dumpies, with very short legs; and the Long-tailed fowls from Japan, with tail feathers six or seven feet in length.

The Bantam breed is the smallest, and comprises many breeds which have been reduced to bantam size. The originals were Cochins. Some of those in Pekin, China, weighing scarcely more than a pound. There are also Game bantams, Malay and Japanese bantams. The Sebright bantam, a highly artificial breed, has the laced feather of the Polish fowl, combined with an absence of male plumage in the cocks.

Poultry raising for the market should be very profitable if properly conducted. Plenty of ground is the first requisite of success, as a hen brings forth a much healthier brood if she can make her nest under a hedge, than if she is confined in a close hen house.

## THE TURKEY

WHEN the Spaniards discovered Mexico, in 1518, they saw the Turkey for the first time. The Indians had been familiar with the bird farther back than their oldest men could remember, and the fossil remains of the Turkey show that he existed long before the earliest time of which we have history.

When the colonists came to settle in the new world, they found the wild Turkey abundant, from Canada to Mexico. They killed so many of them, however, as the country became more thickly populated, that these birds gradually disappeared. It is now fifty years since a wild Turkey was shot in New England. In some parts of



the South, however, especially in Florida, flocks of wild Turkeys are found, and in some places west of the Mississippi River and in Mexico, they are still abundant.

The wild Turkey is about four feet in length, if we measure from the tip of his beak to the end of his tail. His plumage is a copper-bronze color, with metallic reflections of purple, green and copper, and many of the feathers are edged with glossy black. The naked head and neck are blue and have purplish-red excrescences about them, and a thick strip of red flesh grows just over the beak. Sometimes this bit of flesh is long and soft and hangs over one side of the bill, but at other times it is short and stiff enough to stand erect like a little red horn. The tail feathers are a dark chestnut color, barred with black, and the dusky wings are barred with grayish white. The male bird has an odd tuft of bristles which hangs from the breast. With his stout legs and well-proportioned body, his great size and splendid, burnished plumage, the Turkey is a very fine looking bird.

Our familiar domestic Turkey is, of course, a descendant of the wild Turkey found in Mexico and may be distinguished by the white tips to the upper tail coverts. There are two distinct breeds of the domestic Turkey. The Norfolk breed is the taller of the two, and its plumage is black. The little Norfolk chicks are also black, and sometimes show a patch of white on the head. The Cambridgeshire breed is a bird of gayer plumage. In color the chicks of this variety are generally brownish gray.

The Turkey Gobbler is a very pompous old fellow, as he struts about the yard. His call of "Gobble, gobble, gobble"! sounds quite like water being poured from a small-necked bottle.

The female or hen Turkey is dressed much like the gobbler, although her plumage has not so bright a luster. She must lead a very harassed domestic life, for she is compelled to keep the location of her nest a secret from her mate, as he frequently destroys the eggs when he finds them. There are also many outside enemies like the mink, the fox, the weasel and the crow, which are partial to Turkey eggs. So she conceals her nest very carefully under a bush in a tangle of vines. It is simply a hollow scratched in the ground and lined with leaves, grass or feathers. She lays ten or twelve eggs, which are larger than those of the domestic hen, and buff in color, speckled with brown.

In going to her nest, she does not take the same route twice, and she usually starts off in a direction opposite to that which leads to her destination. After wandering and circling about for a time she draws near the nest and, when no one seems to be watching

her, darts quickly into the bushes where it is hidden. She is a faithful mother, and has been known to die of starvation rather than leave her eggs. She must sit upon her eggs for four weeks before they hatch.

## THE GUINEA FOWL

THE origin of the common Guinea Fowl is better known than that of most of the poultry-yard birds. He is a native of Africa, and on the west coast of that continent his untamed relatives are often found in flocks of two or three hundred. They live in woods near the rivers, and their food is grains, grasshoppers, ants and other insects.

There are several species of Guinea Fowl. The one with which we are familiar is rather smaller than the average domestic hen, and usually has a slate-colored plumage, thickly dotted with round, white spots. Occasionally, however, we see him with a coat of pigeon gray, dotted with white. His head and neck are covered with a thick, white skin that is bare of feathers, and on top of his head, in place of the domestic fowl's comb, he has a small, blunt horn.

The Guinea Hen, like the turkey, hides her nest in some out-of-the-way place. This nest is only a hollow in the ground, and when it is hid under a bush or vine it is not easily found. The hen lays from sixteen to twenty-four eggs in a nesting season. These eggs are a yellowish white, dotted with brown, and have thick shells.

## THE GOOSE

THE Goose is found in both the wild and tame states, in the new as well as the old world. Like the duck, he has webbed feet for swimming, yet he is not so much a water as a land bird, for he usually gets his food in the fields. His bill is short and high at the base, unlike the duck's bill, which is wide and flat. His legs are set farther forward and are longer than the duck's, so that he walks and runs more gracefully and more swiftly than the duck does.

Our domestic Goose is larger than the wild bird, as a rule, although some varieties are little larger than ducks. Toulouse and Embden Geese are among the most popular breeds. The plumage of the Toulouse is gray above and white underneath, and the bill and legs are a reddish orange-color. Embden Geese are white, with yellow legs and bill.



## THE DUCK

OUR common domestic Duck is a descendant of the Mallard Duck. He is cultivated as a barnyard fowl, both for the eggs and for the flesh, which is excellent food. The habits of the Mallard, and other wild Ducks, are more interesting to study than are those of the tame Duck, as they have to find their own food and take care of themselves. The tame Duck, in his comfortable quarters in the farm-yard, is usually supplied with food, so that he has little need to swim and dive or exercise his wits, except for amusement.

Wild Ducks in great variety are found in many parts of the world, and in North America alone there are many different species. They are divided into three classes; the Fish-eaters, the Pond or River Ducks and the Bay or Sea Ducks.

The Sea and River Ducks have bills provided with a series of gutters opening on either side. When the Duck plunges his bill into the mud to catch a mollusk, he closes it and then forces out the mud and water through these gutters or strainers, while the food is retained in his mouth.

It is interesting to note the characteristics of the different kinds of Ducks.

The Wood Duck, also called Summer Duck, Tree Duck and Acorn Duck, is the most beautiful of our native Ducks. His plumage is dark brown on the upper part, varied with black, and the head and crest are brilliant green and purple. The throat is white; the breast chestnut color, with spots of white; the under parts white; the flanks buff with wavy lines of black; the wings purple and green; and the bill red marked with black and white. The Wood Duck usually makes his nest in the hollow of a tree overhanging the water.

The Mallard Duck is next to the Wood Duck in the beauty of his plumage. He has glossy green feathers on the head and neck, and a collar of white; the back is brown; the wings gray; the neck and breast chestnut color; and the bill a greenish yellow. A Mallard's nest is little more than a bunch of leaves and grass, with a depression in the center. It is usually found on the ground, near the water.

The Canvas-back and Red-head are two of the best-known Sea Ducks. They are better swimmers than the fresh-water Ducks, but the latter walk or run more easily. The Red-head and Canvas-back are abundant in the Chesapeake Bay, where they feed on the water celery, which is said to give their flesh the flavor that is so much liked.

The Eider Duck is found only in cold climates. The soft, white down, which has made him so famous, grows on his breast.





WOOD DUCK.  
 $\frac{1}{2}$  Life size





From col. Chi, Acad. Sciences.

1. Spotted Sandpiper. 2. Bartramian Sandpiper. 3. Marbled Godwit. 4. King Rail. 5. American Coot.  
6. Least Tern. 7. Sooty Tern. 8. Common Murre. 9. Black Tern. 10. Herring Gull.

## THE SWAN

THE Wild Swan of Europe has a loud note, like that of a horn, but the tame swan is silent, except that, when excited or angry, it utters a hiss. In former times a belief existed that Swans always sang when they were dying, and many stories and fables about the "Swan-song" have been based on this superstition.

In North America there are two species of the Wild Swan. The Whistling Swan has white plumage, with a black bill, on which is a yellow spot between the eyes and the nostrils, and its legs are black. It winters on the seashores of the Southern states and is seldom found north of Chesapeake Bay.

The Trumpeter Swan lives in North America west of the Mississippi River, nesting only in the northern parts of its range. The nest of this bird is made on dry ground rather than near the water, and lined with feathers and down. The noise he makes is said to be similar to that of a horn, but far from being pleasing to the ear.

In Australia we find the Black Swan, which is a large, graceful bird, and as it is native in no other country, has been used as the symbol of the country on Australian postage stamps, just as a picture of the beaver has been used on those of Canada.

## PIGEONS

THE Pigeon is a very popular bird, both as a pet and as a dish for the table. Of the three hundred species of Pigeons in the world, less than one hundred are found in the new world, and North America has only twelve of these.

The Passenger Pigeon, once found in vast flocks in the eastern part of the United States, as well as in the West, now appears only in the central region, and there in small numbers. Thirty years ago, large flocks were found in New England, but they were shot and netted so persistently that they have disappeared from that section.

The breeding of Carrier or "Homing" Pigeons has become a pastime of considerable importance in the United States. In European countries, government recognition is given to the pursuit, and special favors are extended to breeders. The raising of Homing Pigeons is a favorite sport. In Belgium and England they are used to carry messages from lightships to the shore. During the siege of Paris, in the Franco-Prussian War, the pigeon-post became famous. The birds were sent out from the besieged city in balloons. Mes-



sages intended for people in the city were set up in type and photographed on a film about an inch wide and two inches long. This film was then rolled up and fastened to the Pigeon. When the bird arrived in Paris, the messages were deciphered with the aid of a microscope.

Homing Pigeons fly swiftly and their sense of direction is something wonderful. When taken a hundred or a hundred and fifty miles from home and released, the bird mounts in the air, circles about to get his bearings and then flies direct for home. Well-trained Pigeons will not even stop to feed when on a homing flight, unless nearly starved.

There are many varieties of fancy Pigeons. Some of the best known are the Pouter, which expresses pleasure and vanity by puffing his breast, the Fantail, whose tail is permanently spread, and the Tumbler, whose name expresses his characteristic trick in flight.

## BIRDS' EGGS

IN THE spring, when all nature is thrilling with new life, a thousand little dramas are beginning throughout the woodland spaces. Love and joy, sorrow and death, jealousy and disappointment are all vividly embodied in the bird-life enacted amid leafy branches or tall grasses. In the first flush of joy and hope, the little things can do nothing but trill out their happiness in each other and in all the world around them. But long before the spring has drifted into summertime, instinct reminds them that life is not one long courtship, and soon Sir Birdie and his little mate are busily engaged in making preparations for the summer. How exquisite some of the little nests are! In their construction, grace and beauty are often ingeniously combined with utility.

After the house has been furnished with soft linings, the eggs soon arrive, and at once become the joy and the care of the mother's heart. The bird's egg is both a mystery and a revelation. The shell, oftentimes dainty as the petals of a flower, incases the most wonderful organism—a germ of song and buoyant life. Yet many ignore the precious atom, so full of promise for the future, and ruin a bird's nest, as though it were a matter of indifference to the whole world as well as to themselves.

Scientists really promote the welfare of birds by arousing the interest of the public and inspiring a love for the tiny creature. So it is not they who are to blame for the decrease in bird-life. Specimens sacrificed to science do not make serious inroads upon the ranks



EGGS.  
Life-size.

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EGGS.  
Life-size.

of our song-birds. The practice of slaughtering them for decorative purposes has been denounced from press and platform. But the fad for collecting birds' eggs has not been sufficiently discouraged. Setting after setting goes to make up the various collections of the people, who emulate the so-called "licensed collector," who is merely gratified at possessing many rare and valuable specimens.

Thousands of woodland homes are made desolate, and thousands of sweet voices silenced, by this wholesale robbery. Ruthless hands plunder the dainty nest for the sake of adding to the small boy's collection, which is really no aid to science, but a mere fad actuated by a spirit of rivalry. This vandalism is a menace to the crops, as the song-birds are largely responsible for the destruction of various harmful insects; thus the question becomes one of use to ourselves as well as one of sympathy for the birds. Our song-birds stand in imminent peril of becoming wholly extinct, and it is quite time for some reform along these lines, both as to killing the birds and destroying the eggs.

In the study of birds, it is necessary to be able to recognize the eggs of the various species. They seem to have their individual characteristics as do the birds themselves. Some are coarse and somber, while others are as dainty as flowers. But they are all interesting and afford great scope for pleasant study and reflection.

The Red-winged Blackbird usually builds his nest in reeds or bushes near the ground, though he often selects a tussock of grass and sometimes even the bare soil, and occasionally he builds in the high branches of a lofty tree. The materials are usually strips of rushes or sedges, lined with finer grass, or perhaps a few horsehairs. The Blackbird is not one of the finest artists in building, and his nest is rather bulky, and crudely formed. This bird lives in communities, and it is not uncommon to find several nests near each other in a bit of swamp. The eggs are light blue, marbled or clouded with light and dark purple, and with some lines of black. These markings are found chiefly about the larger end of the eggs, though they vary in this respect. There are usually four, occasionally five, in number, and average 1.00 x .75 inches. They are almost elliptical in shape, tapering very little more at the smaller than at the larger end. They are easily distinguished from the eggs of most other birds by their peculiar scrawled markings.

The Quail, which we familiarly call Bob White, makes his nest on the ground in the corner of a rail fence; at the foot of a stump surrounded by a growth of vegetation; or in the garden or cultivated field, where the bunches of tall grass or weeds afford a shelter. A depression in the ground, with a bunch of dry grass, straws, leaves



or weeds serves for a nest, and here Bob White rears sometimes two broods in one season. One setting comprises from fifteen to twenty-five eggs, although there are sometimes only twelve, the average being eighteen. They are 1.25 x .95 inches in size, and are pure white, unless discolored by the grass on which they lie. They are obtusely rounded at one end, while the other tapers until it is quite small and pointed. This pointed end is the most distinct feature of the egg.

That roguish mimic, the Catbird, is partial to thickets and orchards. His nest is usually found in some retired spot in bushes, low trees or clusters of vines. It is seldom more than ten feet above the ground, and is made of dry leaves, twigs and dry grass, with a lining of fibrous roots and grass. The whole structure is bulky and inartistic, and shows but little cunning workmanship. The eggs are usually four, frequently five and rarely six in number. They average .95 x .71 inches and are deep bluish green, without markings. The egg tapers somewhat more at one end than at the other and is easily distinguished by its peculiar uniform tinge of deep blue green.

The Chickadee builds his nest in the deserted hole of a Woodpecker, or in a natural cavity in some tree, perchance in a decayed stump or a hollow fence post. The place is filled with a mass of leaves, moss and dry grasses, while downy feathers, hair from cattle, and often the fur of quadrupeds, make a warm lining for the nest. The eggs are from five to eight in number and the average size is .57 x .47 inches. In color they are white, speckled over the whole surface with reddish brown, which is more thickly distributed at the larger end. The egg is oval in form, tapering slightly more at one end than at the other.

The nest of the Whooping Crane is found amid rank grasses near marshes or in low meadows. It is neatly cupped and built of reeds or grass, on a slight elevation of firm sod. The eggs, which are large and coarse looking, are usually two in number, while they vary from 3.75 x 2.52 inches to 4.06 x 2.38 inches. The shell is rough with numerous excrescences, like little warts. In color it is light, brownish drab, sparsely marked with large, irregular spots of a pale, dull chocolate brown, and obscure shell-markings.

Our barnyard Duck has its origin in the wild Mallard. The latter builds his nest in a field of tall grass near a lake or river. The eggs are six to ten in number, and average 2.25 x 1.60 inches. They are elliptical in form and pale yellowish drab or olive green, usually the latter.

When following her own devices, the common Hen or Domestic Fowl is prone to conceal her nest, which is made of straw or grass, and usually found on or near the ground. But in confinement the

Hen lays in boxes filled with straw, provided for her own special use. The eggs present a variety of different shapes,—some are oval, while others are long and more pointed. In color they vary from white to ivory, and from deep cream to a shade bordering on buff.

The Mourning Dove, also known as the Carolina or Turtle Dove, is one of our best known birds. He builds on the horizontal branches of a tree, on a stump, a rock, or the top rail of an old worm fence, or in bushes. In treeless regions the nest is placed on the ground. Its construction varies according to the location. When found in small branches of a tree, it is made of a few sticks, but if built on a large limb or a stump, it often consists of a mere rim of twigs sufficient to retain the eggs. When on the ground a few straws and twigs are all that indicate the nest. In the South the Carolina Dove rears two and sometimes three broods in a season. There are rarely more than two eggs in a setting. They average 1.12 x .82 inches, being elliptical in form and white in color.

The Bald Eagle is found throughout North America. He builds his nest in a lofty tree or on a rocky cliff high above the sea, the altitude ranging from twenty to ninety feet. The nest is a massive structure made of sticks, lined with roots of grass. The eggs are two, rarely three, in number, about 2.50 x 3.00 inches. They are white, or ivory white, without markings, and the granulated surface is usually discolored by the nest.

The nest of the Crow is found in the wood, and he is partial to high, thick forest and dense foliage. "The loftier the better, if sheltered" seems his motto in selecting a tree, and as a rule his home is practically inaccessible. The nest is large, with a strong frame-work. It is made of coarse sticks, strips of bark, clods of earth and dead leaves. Hog bristles, strips of grape-vine bark, the inner bark of chestnut or oak, as well as the hair of cows and horses, are some of the materials that enter into the lining. Often bits of cloth or lace are appropriated for that purpose, while pine needles or seaweed are sometimes used. From four to six eggs are usually laid, sometimes seven. These vary from a pale bluish to an olive green; and from almost unmarked specimens to those which appear a uniform olive green, so small and dense are the markings. The typical egg, however, is of a light sea green, thickly spotted and blotched with dark brown, bordering on black, which shades off into purplish reflections. The egg averages 1.60 x 1.20 inches. The general form of the egg is elliptical, while one end is rounded and the other quite pointed.

The American Goldfinch builds in all kinds of trees and bushes ranging in height from three to forty feet above the ground. Willows, maples and orchard trees are favorite nesting sites. The nest



is a beautiful piece of workmanship, compactly built of vegetable fibers, moss, grasses, leaves and fine strips of bark, lined with down of plants, usually supplied by the thistle, when the nest is built late enough in the season. The number of eggs varies from three to six, and the average size is .65 x .50 inches. In color they are plain, pale, bluish green, or greenish white.

The nest of the Ruffed Grouse is usually situated at the border of a large wood in the midst of dense undergrowth, often in a thicket; and frequently one finds it in a small wood adjoining a farmhouse. A few feathers or decayed leaves, scraped together on the ground in a brush heap or beside a log or stump, answer for a nest. From six to fifteen eggs are deposited, usually ten or twelve, averaging 1.66 x 1.20 inches in size. They are of a cream color, varying in tint from milky white to a shade bordering on brown. Occasionally, the surface is faintly blotched and speckled with shades of brown.

The Guinea Hen, like the Turkey, hides her nest in some out-of-the-way place. The nest is a mere hollow in the ground, and when concealed under a vine or a bush, usually escapes detection. The Hen lays from sixteen to twenty-four eggs during a season. They have thick shells of a yellowish-white color, dotted with brown.

The natural habit of the American Herring Gull is to nest on the open seashore, but man's persecution often drives him to seek refuge in tall trees. Sometimes the nest is a shallow depression in the ground with only a slight lining, while others are large and elaborate, built of moss and grass. Those in trees are said to be strongly interwoven, and very compact in texture. Usually, the eggs are three in number and range from 2.73 x 1.64 to 2.91 x 1.94 inches. They are elliptical in general form, with one end rounded, while the other is considerably pointed. They vary from bluish white to deep yellowish brown, irregularly spotted and blotched with brown of different shades. In a large collection the ground color and markings are very diverse.

The eggs of the Nighthawk are deposited among stones, or on the bare ground in a field; perchance on a stump. Scarcely a trace of a nest can be found. The eggs are two in number and range from 1.21 x .82 inches to 1.52 x .87 inches. They are elliptical in shape, with one end larger than the other, and vary from pale olive gray to buffy and grayish white. The surface is thickly mottled and dashed with varied tints of darker gray, slate olive, even blackish, while a marking and clouding of purplish gray is intermingled with the various markings.

The nest of the Prairie Hen or Pinnated Grouse is placed on the ground in the midst of the thick prairie grass, or at the foot of bushes on the barren soil. A hollow is scratched in the earth, while a scant

lining of feathers and grass blades are the only pretense of a nest. The eggs are usually eight to twelve in number and the average size is 1.75 x 1.25 inches. They are rather oval in form and their color is light drab or dull buff, sometimes an olive hue, the surface is occasionally sprinkled with brown.

The nest of the Humming-bird is usually placed on a horizontal branch of a forest or orchard tree. It is felted with a mass of soft silky or woolly substances, such as the down of plants, while the outside is covered with lichens. It is cup-shaped and exquisitely dainty in texture and workmanship. The eggs are invariably two in number, and the average size of those of the Ruby-throated Humming-birds is .50 x .35 inches. They are elliptical rather than oval, and of a pearly whiteness. The pretty nest and diminutive egg of the Humming-bird are easily distinguished from those of other birds.

The Blue Jay's nest is found in the lonely forest, as well as in orchard trees or by the roadside. It is large and rudely built of twigs, roots, leaves and vegetable fibers, strongly interwoven. The eggs are four or five in number and range from 1.02 x .84 inches to 1.18 x .86 inches. They are olive brown or olive drab, thickly spotted with dark, olive brown. In some specimens the ground color is light or dark green. The egg is elliptical, with one end more pointed than the other.

The nest of the Kingfisher is an excavation in the perpendicular bank of a stream or gravel pit. As a rule the entrance is about two or three feet below the surface. The tunnel is usually straight, but sometimes the bird digs an angle from three to six feet or eight feet in length. The eggs are deposited in the midst of bones, scales and other refuse of his food. They usually number six, sometimes seven or eight, and are about 1.25 x 1.05 inches in size. The egg is of a clear shining white, almost spherical in shape, with one end slightly more rounded than the other. Its glistening whiteness is the feature that distinguishes the egg of the Kingfisher from those of other birds.

The fields and meadows are the home of the Meadow Lark. The nest is built on the ground, in a thick tuft of grass. It is rather compactly made of dry wiry grass, lined with finer blades of the same. It is usually formed with a covered entrance in the withered grass surrounding the nest, through which a hidden and sometimes winding path is made, as a rule so well concealed that the nest is betrayed only when the birds are flushed. The eggs range from four to six in number, and average 1.10 x .80 inches, with great variety in that respect. They are almost elliptical, with one end smaller and less rounded than the other, while in color they are crystal white, more or less thickly spotted or dotted with reddish-brown and purplish.



The Mocking-bird builds in the hedges, in trees or on fence rails, sometimes not ten feet from a dwelling. The site depends upon the resources of the various localities; sometimes a brush-heap is the spot that commends itself to the bird as a favored nook for housekeeping purposes. Small twigs and weeds are the materials generally used in making the nest, while the lining is composed of roots, sometimes of horsehair and cotton. The eggs usually number from four to five, rarely six, and range from .87 x .68 inches to 1.05 x .80 inches, the average size being 1.00 x .75 inches. The ground color varies from pale, greenish blue to a dull, buffy shade, marked with spots and blotches of yellowish brown, russet or chestnut.

The Nightingale of Europe builds his nest in woods, hedgerows or copses. It is made of leaves, grass and roots, and placed on or near the ground. The eggs are four or five in number, and average  $\frac{1}{3} \times \frac{1}{2}$  inch in size, while in color they are olive brown.

The Orchard Oriole suspends his nest from the boughs of a tree in the orchard or grove, rarely in a lonely forest. The dainty cradle is woven like a substantial basket of fresh blades of grass, and lined with feathers. The grasses soon dry, and the nest long retains its beautiful pea-green color. Double nests are sometimes found hanging from the trees. The eggs vary from .70 to .86 inches long, by .50 to .62 inches broad. They are of a bluish tint, with spots and specks, as well as a few large blotches, and irregular zigzag lines of various shades of brown. The general form is that of a narrow ellipse, smaller at one end than at the other. The half-hanging nest, as distinguished from the fully pensile nest of the Baltimore Oriole, is a sure indication of the species to which the egg belongs.

The Ostrich digs a broad, shallow hole in the sand for a nest and here several hens deposit their eggs. Sometimes there are as many as sixty in one nest, and, contrary to the usual custom, the male birds sit on the eggs. Several may occupy the large excavation at one time, in order to cover all the eggs. These are very large, averaging three pounds each in weight. As a rule, they are placed on one end in the nest for the purpose of economizing space.

The Screech Owl, often called the Little Horned or Red Owl, makes a nest in a hollow tree or stump, often in the topmost corner of an old barn or shed. A few sticks, leaves and feathers are the chief materials that enter into its composition. The eggs number from four to six, frequently eight, and average 1.40 x 1.20 inches in size. They are white, and almost spherical in shape. The form of the egg is the chief feature that distinguishes it from those of birds belonging to other families.

The Carolina Parrot is wont to nest in colonies. His favorite haunts are the cypress swamps. He is supposed to nest in a hollow tree. The eggs, about 1.40 x 1.05 inches, are oval in shape, and rather pointed. Some are pure white, while others are tinged with deep ivory or tintured faintly with green.

The nest of Gambel's Partridge is a mere depression in the soil, sometimes without a lining to soften the bare ground. The eggs are eight to sixteen in number, and average 1.25 x 1.00 inches. At one end the egg is obtusely rounded, while the other is comparatively quite pointed. The creamy-white ground is relieved by scattered spots and blotches of old gold, sometimes chestnut red and light drab. The effect of the old gold against the creamy-white background is rich and beautiful, and these markings are the feature that distinguishes them from the eggs of other birds.

The Peacock selects some retired spot for a nest, which is a mere depression in the ground with a lining of leaves. The eggs are about as large as those of a goose, and but one brood is reared each year.

The nest of the Ring-necked Pheasant is made on the ground in sparse weeds or in an open field, perhaps in a tussock of grass, or under a small bush. Dry leaves and grass are the chief materials in its composition. The eggs number from seven to fifteen, and the average size is 1.61 x 1.31 inches. Some are buff color with a bluish cast over the surface, while other specimens are a yellowish buff throughout.

The Wild or Passenger Pigeon used to congregate in vast communities for the purpose of breeding, but it has been so nearly destroyed by man that it no longer nests in large rookeries. Trees and bushes are his favorite sites, and the nest is frequently at a considerable height from the ground. It is a mere platform of sticks carelessly thrown together. The eggs are usually one, never more than two in number, and average 1.48 x 1.04 inches. They are broadly elliptical in shape, and pure white without markings.

The nest of the Piping Plover is a mere depression in the sandy beach. The eggs are four in number and the average size is 1.29 x .95 inches. They are pyriform in shape, quite pointed at the smaller end, the other being obtusely rounded. The egg is pale buff, finely speckled with black and purplish gray. In some specimens the markings are much more profuse than in others.

The Robin of America builds in the crotch of a tree or on a horizontal branch, and very often on a stump or the top rail of a fence. All sorts of curious places are likely to be selected as favorable sites,—even bird-boxes,—though orchards and shade trees along the streets are his common choice. The nest is rather large and is coarsely



constructed of twigs, grasses, dry leaves and hair. It is strengthened by a cup of clay neatly molded and surrounded by these materials. The eggs are usually four, rarely five in number, and average 1.16 x .80 inches in size. They are elliptical in general form, smaller at one end than at the other, greenish blue without markings.

The Skylark of Europe builds his nest in meadows or open grassy places, often under the protecting shelter of a clod of earth, a tuft of grass, or some other projection. The nest is composed of grasses, plant stems, and a few chance leaves, with a lining of the same class of materials, but finer in texture. The eggs number from three to five, and range from .95 x .64 inches to .84 x .58 inches. They vary considerably in form and coloration. Some are grayish white, tinged with purple or greenish white, with speckles of grayish brown or drab. Others are of a deeper and more somber hue, and in some the markings are chiefly about the larger end.

The nest of the Song Sparrow is usually found in low bushes or on the ground, although it is occasionally built in trees or climbing vines. It is composed of grasses, roots, stems and leaves, lined with fine grass-stems or hair. As a rule, the eggs are four or five in number, though they sometimes reach six, and rarely seven. They are so diverse in size and coloring that this species often represents the eggs of a number of ground birds in the small boy's collection. They range from .75 to .85 inches in length, by .55 to .60 inches in breadth, while in form they are oval at the smaller end. The egg varies from greenish or pinkish white to light bluish green, spotted with dark reddish brown.

The nest of the Cliff Swallow is attached to the perpendicular face of hard embankments. It is usually retort or flask shaped, but some have no necks or fail otherwise to carry out the idea of a bottle. The nest is made entirely of mud, and comfortably lined with straw, wool and feathers. During the breeding season the birds are always found in colonies. The eggs vary from four to five or six in number, and the average size is .82 x .56 inches. They are elliptical in form and one end is somewhat smaller than the other. The ground color is white, relieved by dots, blotches, and points of reddish brown. The peculiar form of the nest indicates the species to which the egg belongs.

The nest of the Wild Turkey is on the ground, and very securely hidden in tangled briars or tall, thick grasses. A mere depression in the soil, with a scant lining of stray feathers or blades of grass, is the only nest of which this bird can boast. The number of eggs varies from nine to eighteen, but nine to twelve usually constitute a brood. The average size is 2.55 x 1.80 inches, the small end tapering considerably more than that of the domestic fowl. They are rich, dark

cream color thickly sprinkled with rounded spots of rusty brown. The distinct features are the markings of the eggs and the location of the scantily furnished nest.

Dense underbrush and rocky ravines shaded by thick foliage are the favorite nesting sites of the Whip-poor-will. The eggs are found on the ground, on decayed wood or among fallen leaves. Two eggs constitute a set and average 1.25 x .90 inches in size. They are elliptical and have a smooth surface. The ground color is cream or white, and yellowish-brown spots of varying size are distributed rather freely over the entire surface. Occasionally, these handsome markings are varied with a few blotches. Deep shell marks of a lilac-gray or lavender tint are about as numerous as those dotting the surface.

The nest of the Woodcock is a mere depression in some dry spot in swampy land, usually sheltered by a clump of briars or other wild shrubbery, but often found in more open places. The eggs average 1.50 x 1.18 inches. They are pyriform, but more rotund than those of most of the small waders. In color they are creamy or buff, irregularly and thickly spotted with varying shades of pale, reddish brown.

The Red-headed Woodpecker builds his nest in orchards, groves, the deep forest, or perhaps in a solitary tree in a field or on the open prairie. The bird usually digs a cavity for the nest in a decayed tree, sometimes in a telegraph pole. The eggs are five or six in number and average 1.12 x .85 inches in size. They are elliptical in general shape, but one end is smaller than the other, while the somewhat irregular outlines destroy the effect of the oval. The yolk, showing through the translucent shell, imparts a delicate pinkish tinge to its clear glossy whiteness.

The Common House Wren builds his nest in every conceivable nook and crevice. Under the eaves of houses, corners of the barn, hollow trees and martin-boxes are common building sites. The nest is composed of a mass of various kinds of rubbish, sticks, grass, hay and other available materials. This industrious bird will fill a box or cavity that holds a peck in order to make it available for nesting purposes. The eggs are usually seven, sometimes nine in number, and average .64 x .52 inches with great variations in respect to size. In form, they range from spherical to oblong-oval, and are white, slightly tinged with purple, so thickly dotted with reddish brown that they often give the impression of being a uniform chocolate color.



## THE PRAIRIE HEN

THE Prairie Hen belongs to the Grouse family and is an excellent game bird. Formerly this species of Grouse was found in some of the eastern states, but it seems now to be confined wholly to the middle northern country, with Indiana and Illinois for eastern bounds. This bird is plentiful where there is a range of dry, barren country, for he dislikes a wet soil.

The Prairie Hen is about eighteen inches long, so that he makes a generous dish for the table. The feathers are yellowish brown, tinged with gray and barred with black. The throat is buff, and white appears on the breast and underparts.

On the head is a small crest and on the sides of the neck are eight or ten long, stiff feathers, which ordinarily lie against the neck, but are erected when the bird is excited or angry. Just below these feathers, on either side of the neck, is a patch of bare skin, which the bird can expand at will into a ball. The legs are thickly covered with feathers all the way down to the feet.

The nest is made on the open prairie, under a bush or in the long grass. It is a mere hollow scratched in the earth and lined with grass and feathers. It is usually so well concealed that the traveler does not notice it unless it lies directly in his path. The female lays from eight to a dozen eggs, which are a greenish gray, sometimes marked with dark specks.

He sometimes utters a hoarse, hollow, croaking sound, which might be mistaken for that of a bullfrog. During this process, he blows out his neck pouches until his head is almost concealed. Perhaps the latter part of the performance is a challenge to rival birds. The challenge is promptly accepted and soon the battle is raging with a great show of valor on each side. Each attempts to frighten the other by his very fierce aspect. He ruffles up his feathers and scratches up the ground, all the while scolding in a sharp cackle.

The male bird is not a domestic character by any means. He refuses to do his share in bringing up the family. Nor does he trouble himself to provide for his mate during this trying period. When the chicks are hatched, the mother looks after them, scratching up worms for them to eat and sheltering them under her wings, like our domestic hen. If danger approaches, the chicks scamper into the grass or bushes and remain quiet, while the mother, by feigning lameness, endeavors to lead the intruder away from the place where the chicks are concealed. She performs her tricks much as the Ruffed Grouse or "Bob White" might do.

Acorns, wild strawberries, huckleberries and insects are the chief food of the Prairie Hen. He sometimes visits the grain fields and eats buckwheat, or nips the leaves of the clover. In winter, beechnuts and buds supply his food.

The Heath Hen was once found in some of the Atlantic states, but is now exterminated, except perhaps in Martha's Vineyard. He is very similar to the Prairie Hen, and makes a nest in sparse woods of scrub oak or pine growth.

The Prairie Chicken, or Sharp-tailed Grouse, is a little smaller than the Prairie Hen. His plumage is striped with black and brown, and the wings are spotted with white. He has no neck-feathers, like the Prairie Hen, but in his habits he resembles the latter bird. He is found in the northwestern part of the United States and across the Canadian border. His flesh is very toothsome, and often makes an excellent meal for the plainsman who chances to start up a bevy of these birds.

## THE QUAIL, THE PARTRIDGE AND THE GROUSE

COLONEL WILSON, of Virginia, was visiting his friend, Mr. Parker, at the latter's home in Massachusetts. It was in autumn, and as the two gentlemen sat on the piazza of Mr. Parker's house, the latter's two sons came up the walk with guns over their shoulders and each with a string of birds in his hand.

One of the boys held up his birds and Colonel Wilson exclaimed: "What a fine bag of Partridge!"

"You mean Quail, I guess, don't you, Colonel?" said Mr. Parker.

"Quail? No, indeed; I ought to know Partridge when I see them—I've shot hundreds of them."

"Well, but here are your Partridges," said Mr. Parker, taking a string of birds from his other son.

"Partridge? Why, my dear sir, those are Pheasants!"

"We call them Partridges in New England," said the Massachusetts gentleman.

"Can't help that," said the Colonel, a little nettled; "the other boy has the real Partridges."

Each gentleman was prepared to insist that he had called the birds by their right names, when up the drive came a man with a fishing-rod over his shoulder and trousers tucked in his boots. "Ah," said Mr. Parker, "here's Professor Bridges. He's an expert on birds; we'll let him decide the question." So the dispute was referred to the naturalist.



He smiled as he heard the gentlemen defend their positions; then he said: "Well, the fact is, it all depends on the part of the country you come from. Now, these birds, which Mr. Parker calls Quail, are always called Partridge in the South; and the birds which Colonel Wilson calls Pheasants, and which go by the name of Partridge in New England, are really Grouse. The best way out of it is to follow the adage, 'When in Rome do as the Romans do,' and name your birds according to the locality in which you find them."

"Well," said Mr. Parker, "suppose we compromise on 'Bob White' as a name for my Quail and the Colonel's Partridge," and then there was a laugh and a general assent.

Because his note sounds something like those words, "Bob White" is the nickname given to the Quail of New England and the Partridge of the South. Some poet has written a poem about "The Whistle of the Quail"—of course he was a New England poet! At any rate it is the whistle of this bird that gives him his nickname. Sometimes his call is translated to mean "More wet, more wet!" and this is said to be a sure sign that rain will fall soon.

This bird is one of the most delicious tidbits for the table to be found among the game birds, and is so much in demand that he has disappeared entirely from some sections. In most states it is unlawful to shoot him, except during a few weeks in the fall.

"Bob White" has a coat of reddish brown, mottled with gray, black, buff and white. A stripe of white over his eye and a patch of white on his throat, with white and black marking on his white vest, complete his coloring. Including his tail, he is about ten inches long.

The matter of a nest is very easily settled by this bird. He makes it in a slight depression in the ground, with leaves and grass loosely arranged about it and here the eggs are laid, white in color and from ten to twenty in number. The nest is rarely found in thick woods, but usually in a thicket of bushes, or in the grass of a field.

When the bird is "flushed," or frightened from cover, he rises in the air with a "Whir-r-r!" caused by the rapid strokes of his short wings. He can run very swiftly and prefers the ground to the air when he is seeking to escape an enemy.

"Bob White" is not a bird of passage, and does not migrate from the colder to the warmer climate in winter. He does not seek to avoid the snow, which, however, sometimes overtakes and kills him. If not seriously disturbed by the hunter, he dwells in the same "cover" of bushes several years in succession. During the winter he is content to feed on berries and buds, and occasionally pays a visit to the farmyard, in search of chance grains of corn overlooked

by the poultry. In the summer he eats corn, rye and buckwheat, the seeds of wild plants, and insects.

These birds are good-natured, and, for the most part, seem to be very fond of each other. They live in families, sometimes numbering only four or five birds, and at other times as many as twenty or thirty. They roost on the ground in a circle, with their tails pointing toward the center and their heads outward, so as to be ready to run in all directions at the least alarm. They are shy birds, but may be tamed, nevertheless, and the mother birds will even sit on hen's eggs and hatch out a brood of chickens.

A mother bird will often try to deceive the hunter by running along on the ground, limping and complaining, as if wounded. It is only a trick to draw the sportsman's attention from her little chicks, which can easily hide in the grass and leaves, the color of which they so much resemble, and keep perfectly quiet while their mother flutters about, always seeking to draw the enemy farther away from their hiding place.

The Ruffed Grouse is the real name of the bird called "Partridge" in the North and "Pheasant" in the South. He is a beautiful bird, although he has no brilliant colors. Nature always gives the ground birds, or those which seek shelter in the bushes and grass, dull coats of brown or gray, in order that they may be less easily seen. The birds which live among the foliage of trees and fly high in the air when disturbed, can safely wear brighter colors, since they do not try to escape by hiding.

The upper parts of the Ruffed Grouse are mottled brown and gray, marked with brown and dull white. The head has a crest and a ruff of black feathers on the sides of the neck. The under parts are buff, and the soft feathers of the breast are marked with brown. This bird is much larger than "Bob White," and, when he chooses, can spread his tail-feathers, which makes him look still larger. He is fond of the "partridge berry," strawberries, grapes, huckleberries and the buds of apple-trees.

The Grouse prefers to make his home in rough countries, where there are thick bushes and growths of scrubby trees. The nests are simply a hollow cushion of grass and leaves, like that of "Bob White."

In the spring, he makes a sharp drumming noise which is peculiar to his kind. It sounds like the roll of a kettle-drum and may be heard at some distance. The bird makes this noise with his wings, and it is a sign that he is full of good spirits, or perhaps it may be a challenge to other Grouse to join in a quarrel. During the summer, Grouse like to flutter in the dust, as we often see hens do, and for this purpose they sometimes go to the highway, where the soil is fine



from the constant crushing of wheels and feet. Usually, however, they are to be found only in their favorite thickets, where they spend most of their time near the ground. Like "Bob White," they run from danger, and the mother Grouse practises the same deception on the hunter, by pretending to be wounded and seeking to lead him away from her chicks.

Other species of Grouse are called by such names as Dusky Grouse, Pinnated Grouse or Prairie Chicken, Canada Grouse or Spruce Partridge, White Grouse or Willow Ptarmigan; and in Europe is found the Black Grouse or Black Cock, which utters a crow somewhat like that of a rooster.

Nearly all Grouse are alike in habits, differing slightly in various sections of the country. Everywhere they are esteemed as game birds and are shot and trapped in large numbers to supply the markets.

## PHEASANTS

PHEASANTS are old world birds, and there is no reason why the name should be given to any native American bird, as it is in the South to the Ruffed Grouse. They have been common birds in Asia for many centuries and have been introduced in most of the countries of Europe. The Common Pheasant was carried into England, some say by the Romans, and others say at the time of the Norman Conquest, 1066 A.D., and since that time has been considered a "game" bird, although American sportsmen would think it a very tame sort of game. Noblemen who have large estates and "shooting preserves" breed these Pheasants in great numbers. The birds are turned loose in the woods, where they live in a half-tame, half-wild state, and when the owner of the estate wishes to entertain his friends, he invites them to a Pheasant shoot. Beaters enter the woods and frighten the birds from their haunts, and the gentlemen sportsmen follow with their guns, to shoot as many as they can. Hundreds may be killed in the course of a single day, as it is no difficult feat to shoot them. The flesh of the Pheasant is delicious for the table.

There are many species of the Pheasant. Nearly all have beautiful plumage, with very long tails. The "cock" or male of the Common Pheasant is about three feet in length and the "hen" a foot less. They make nests in a thicket or hedge. Usually it is a simple hollow scratched in the ground and lined with grass and feathers. The eggs, which number from eight to twelve, or even twenty, are nearly two inches long, of a brownish or greenish color.



FROM COL. CHI. ACAD. SCIENCES.

RING-NECKED PHEASANT  
 $\frac{1}{6}$  Life-size.

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FROM COL. CH1. ACAD. SCIENCES.

AMERICAN WOODCOCK.  
 $\frac{2}{3}$  Life-size.

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The Ring-necked Pheasant is one of the common varieties. This bird has plumage of yellowish brown, with spots of white above and darker brown spots; his breast is purplish chestnut, with regular spots of black. His long tail is barred with black. Around his neck is a ring or collar of white on a ground of beautiful dark green, shading to purple or black near the bill. Around the eye is a patch of bare, red skin. These birds are raised to some extent in the United States, and an effort to introduce them is being made in some of the middle and western states. Well-bred birds are liberated in suitable localities and protected by law. In Ohio, this experiment is being tried on a large scale, and it is believed that the Pheasant will render valuable service to the farmer by destroying injurious worms and insects. This Pheasant makes a nest in an open field, and seems to have many habits of the quail. He is a swift runner, and seeks hiding at the first warning of danger, crouching low on the ground or in the grass, where the color of his plumage makes it difficult to see him.

In China and Japan, Pheasants are abundant, and have very beautiful plumage. One of the Chinese birds is the Golden Pheasant. It is hard to describe his wonderful display of colors. His crest and the plumes on his back are golden yellow; his breast orange red; on his wings are black, purple and brown; below his neck, salmon pink, barred with black. His long tail-feathers are black, with beautiful mottlings of yellow.

The Silver Pheasant, another bird from China, has silvery-white plumage with purplish black underneath, a black crest and a diamond-shaped patch of red about the eye.

The Copper Pheasant has plumage of a rich copper color. That of the Japan Pheasant resembles the green and purple plumage of the Peacock; and besides these there are many other species, all of which have exquisite coloring.

Not all the Pheasants are bred to be shot, for the quality of the flesh varies somewhat with different varieties. The more brilliantly colored birds, like the Golden Pheasants, are usually raised for the pleasure of seeing their beautiful plumage.

Pheasants are ground birds. They take only short flights, but they run swiftly and are very graceful in their motions. Their legs are armed with sharp spurs like those of the gamecock, and in a fight they use them savagely. Grubs and worms, beans, grass, acorns, berries, grain and leaves comprise the food of these birds.



## THE WOODCOCK

THE American Woodcock is one of the most sought of the game birds, for the delicate flavor of his flesh makes him a choice morsel for the table. He is found in eastern North America and remains in New England as late as December, when he makes his way to the South to spend the remainder of the winter.

This bird is a peculiar looking fellow. He is about eleven inches long, has a very long, straight bill and short legs. His tail, too, is so short that at first glance you might think he had none. His head is still more remarkable, however, for it comes almost to a right angle at the nape, and the neck is so short that the head seems joined directly to the body. Then, too, the Woodcock's eyes are very large and set near the top of his head. Altogether, he is not likely to be mistaken for any other bird. His coat is a tawny color, mixed with black and gray, and underneath it is a reddish yellow, tinged with gray.

His long bill is given him for boring, not in trees, like the woodpecker, but deep in the earth, where he finds worms and other living food.

The Woodcock's nest is usually found in a wet meadow or swampy thicket, but he does not like too much water, and sometimes builds in the dry woods. The nest is a mere hollow in the grass, lined with leaves. In this nest the female lays four eggs, about an inch and a half long, which are pale buff in color and spotted with brown and lavender.

We have noticed that the Woodcock's eye is very large. This is undoubtedly due to the fact that he goes abroad mostly at night and his eyes are intended for seeing in dark places. During the day he stays quietly hidden in the thicket or the grass, but as evening comes on he starts out in search of food. He is often out late at night, and again in the early morning he is very active, but as soon as the sun is fairly in the sky, he returns to some shaded place.

With his long, slender bill the Woodcock can pierce to a depth of several inches. He turns over the leaves and bores in soft, boggy ground for the worms which he is pretty sure to find. Sometimes you find a number of holes near together, which look as if they might have been made by the tines of a pitchfork, and it is an indication that the Woodcock has been digging worms. It is supposed that he has a very keen sense of touch, which helps him to secure the insects and worms hidden underground.

The Woodcock utters a warbling call, and in flying, the rapid strokes of his short wings make a sharp whistling sound.

## THE PLOVERS

THERE are nearly a hundred species of Plover, which are shore birds, or waders, in many respects similar to the snipe. Some species, however, visit the uplands and are not exclusively shore birds. The Plovers, moreover, except in three species, have no hind toe, and their legs are long and slender, while the snipe has a short fourth toe at the back of the foot. The Plover's head is so nearly round that it seems like a ball into which a skewer has been stuck, for the bill is slender and sharp. He does not use it to probe the ground, as the snipe does, but picks his food from the surface.

The Whistling Plover, known in this country as the Black-bellied Plover, is common in almost all parts of the world. His upper plumage is gray, spotted with black and pale yellow; the under feathers are black in summer and change to gray and white in winter.

This bird makes a singular nest—a mere depression in the beach, into which he puts a wisp of grass for lining. Although he nests near the sea, he is not web-footed, and feeds more on land insects than on those found only about the water. Grasshoppers and beetles are a favorite diet with the Plover, and he eats berries in their season.

The Killdeer, a well-known member of the Plover family, is found in nearly all parts of North America. His name is given him because of his cry "Kill-dee, kill-dee," which he repeats so monotonously that it becomes tiresome to the ear. The Killdeer is a restless bird. He runs swiftly on the ground and is strong in flight, and often soars to great heights. The Killdeer makes a nest after the fashion of other Plovers, by simply scooping a hole at the upper edge of the beach or on the border of a meadow. The eggs are buff or drab, spotted with dark brown. Plovers' eggs are more sharply pointed than the eggs of other birds. During the breeding season, the Killdeer is full of anxiety lest his nest be disturbed, and will fly about the head of an intruder or run along on the ground, pretending to be lame, all the time screaming "Kill-dee, kill-dee," to draw attention away from the nest. Worms, grasshoppers, crickets and other insects are the chief food of this bird. His flesh is not especially palatable, yet it is sometimes eaten.

The Upland Plover is a familiar game bird, and his name is well known among sportsmen. He is also called the Field Plover and the Bartramian Sandpiper. He really belongs to the Sandpiper family, for he has the fourth toe, which other Plovers lack, and his bill is long, like the Sandpiper's. His plumage is mottled brown, black and



buff, the breast streaked with dusky feathers and the under parts white. He is about twelve inches long, and his flesh is excellent for the table. This bird ranges from the far fur countries to the pampas of South America, and is particularly abundant on the plains of the West.

Their nesting habits are like those of other Plovers. They feed on insects and destroy uncounted multitudes of grasshoppers, to the great good of the farmer. They are shy birds and, when alarmed, run through the grass very swiftly. If they take flight, they utter a low soft whistle which has a complaining note, as if in protest against being disturbed.

## THE RAILS

TO THE Rail family belong many species of birds which are scattered throughout the temperate regions of the globe and are variously known as Rails, Corn Crakes, Moor Hens, Mud Hens, Marsh Hens, Gallinales and Coots. The Water Rail of Europe is the type of the group. It has a slender, straight bill, a little longer than its head, long legs and long toes, short wings and short tail and compact body, which tapers rapidly toward the head.

There are more than sixty species of Rails. They are marsh birds, and live along the borders of rivers and swamps. They swim and dive well, and run very swiftly; but they fly heavily and only for short distances at a time. When they migrate, however, they seem to summon enough energy to take long flights. They feed on insects, the seeds of water plants, slugs, worms and small shellfish. With their sharp bills they pick many tiny creatures from the mud of the marshes. These birds are often called Marsh Hens, for they utter a cackle much like that of the domestic hen, and also move their heads back and forth as she does when walking.

The King Rail is also called Red-breasted Rail, and Fresh-water Marsh Hen. He is found in the middle and southern states, usually near fresh water. This bird is about eighteen inches long. His plumage is brown on the upper parts, striped with black; the throat is white; the breast and upper wing feathers reddish chestnut; flanks barred with white and dark brown or blackish.

The nest, made of grass and weeds, is placed on the ground and hidden in the rank grass of the marsh, or fastened to the reeds growing about it. The eggs range in number from six to twelve, and are white or buff, marked with brown and lilac.

The Virginia Rail is much like the King Rail in his habits, but he is little more than half as large, and there is more of the reddish

color in his plumage. He is a fresh-water bird and rarely visits the marshes near the sea, unless there is fresh water near by. He is found throughout the middle and southern states and as far north as Massachusetts. This bird is not often seen, for he spends nearly all his time among reeds and rank grasses of the marsh, and when alarmed runs swiftly through the rushes. He flies but little, and never perches on trees or bushes.

The Clapper Rail is also called the Salt-water Marsh Hen and Mud Hen. He is fourteen or fifteen inches long, and has a long, slender, slightly curved bill. His plumage is much like that of the King Rail, but paler, duller and grayer. The bird is found all along the Atlantic coast, as far north as Long Island, or even Massachusetts, and spends the winter on the shores of the Gulf of Mexico. The Clapper Rail is always found in salt-water marshes. When the female lays her first egg, she drops it into a trifling hollow, surrounded with a wisp of grass, but, as others are added, she adds to the nest, until it reaches a considerable size. The long grass about it is then arched over the top. The eggs are as large as those of a bantam hen, and are good to eat. The hawks, crows, foxes and minks like them as well as men do, and often rob the nests.

The Sora Rail has other names—Common Rail, Carolina Rail and Carolina Crake. He is a common bird in nearly all parts of the United States, but is most abundant in the middle and southern states. He is a fresh-water marsh bird, but is also found on tide-water creeks. He is even smaller than the Virginia Rail. His plumage is a mixture of brown, black and gray, and the under parts are barred with ashy white. His bill is yellow, and is much shorter and stouter than those of the other Rails. His flesh is excellent for the table, and in the fall he is persistently hunted.

All Rails are shy birds and you must go to the marshes to see them. Even then you may watch a long time without spying one, for their plumage is so much like the reeds and grasses in color, that they are not easily distinguished. They spend nearly all their time on their feet and are constantly seeking insects, seeds and small shellfish for food. They are very nimble and can outrun a man. Their bodies are very thin, so they slip easily through the narrow spaces between the reeds. You have heard people described as being "as thin as a Rail," and when you have seen one of these birds, the description is full of meaning. When they run, they stretch out their necks and erect their short tails, and are comical-looking creatures. They are harmless birds, for they never trouble grains or fruits, but other birds, animals and men hunt them to get their eggs and flesh.



## SNIPES AND SANDPIPERS

THE Snipes and Sandpipers are shore birds. They have long legs for wading and long bills for seizing their food in the sand or water. There are many species of these birds and some of them are common in all parts of our country, as well as in Europe.

Wilson's Snipe, which is also called the English Snipe, Guttersnipe, Jacksnipe and Shad Bird, is one of the best known of the family. He is found throughout the United States, in every locality where marshes or wet meadows offer suitable feeding-ground. He spends the winter months chiefly in the West Indies and Central America. Wilson's Snipe wears a coat of brown, black and buff. The markings are irregular and give him a curiously mottled appearance. On his short tail appear bars of black and some reddish feathers. His underparts are white. He has a long, narrow, pointed bill. His legs are dusky brown and the middle toe is very long. The bird's full length is about twelve inches, of which his bill is two and a half inches.

Near the edge of the marsh, the Snipe makes his nest, in a tuft of grass or on a bed of moss,—a slight hollow which he lines with grass and leaves. Three or four eggs of a brownish-olive color, marked with brown, are laid.

The Snipe makes a peculiar humming or whirring sound while in flight. His food consists of worms and tender roots, for which he bores in the soil with his long bill.

The flesh of the Snipe is delicious and Snipe-shooting is a favorite pursuit with sportsmen. They are active birds and seem to know by instinct when the pursuer is looking for them. When startled, they rise in the air and dart upward and downward in confusing curves, so that the man with the gun must be an excellent shot to make sure of his game.

The Least Sandpiper is only half the size of Wilson's Snipe. Black, reddish and white plumage appear in his coat; his under feathers are white, with dusky spots. His bill is stout and sharp, but only one-third as long as that of the Snipe.

This little bird is common on all the shores and marshes of North America. He breeds in the arctic regions, but in the winter he ranges as far south as Mexico. He travels from place to place in great flocks, and for this reason makes an easy mark for the sportsman, who finds the flesh palatable, although it is not equal to that of the Snipe. When startled, these birds utter a sharp little cry of "peep, peep," and the name Peep is often applied to them.

Their feeding habits are somewhat like those of the Snipe, and the worms, crabs, small clams and insects which they find about the

shore are their only food. They bore in the sand or mud in search of food, as the Snipe does. You may often see them on the beach, running about on the sands at a lively gait and fluttering just out of reach of the coming waves. If you watch them closely, you will see that they are picking up the tiny creatures cast up by the sea.

The Curlew Sandpiper, the Red-backed Sandpiper, the Pectoral Sandpiper and the Semi-palmated Sandpiper are other birds of this family, all larger than the Peep. The last named has partially webbed feet.

The Spotted Sandpiper is one of the common species, most remarkable for his habit of wagging his tail, which gives him the familiar name of Tip-up or Teeter-tail.

## THE EAGLE

WITHOUT a doubt the Eagle is the "King of Birds," but his reign is one of terror, and his scepter a symbol of despotism. He is the pirate of the air, who robs the weaker birds of their prey rather than catch his own. In cunning and intelligence he is inferior to many birds of smaller size, but physically he is well equipped for his throne. For strength, courage and swiftness of flight he surpasses most other birds, and in the defense of his young will even attack a man.

The ancient Greeks and Romans venerated the Eagle, and before their time, the monarchs of Persia made this mighty bird a symbol of their power. The Romans placed a representation of the Eagle on their imperial banners, and believed that its lofty flight enabled it to be the messenger between Olympus, where Jove ruled the heavens, and the earth below. You will see the doubled-headed Eagle on the imperial flags of Russia, and in the fourteenth century, the black Eagle became the emblem of Prussia. The symbol of our own country is the American Eagle. You will find him represented on our silver coins; our ten-dollar gold coin is officially known as an "Eagle" and the twenty-dollar gold coin as a "double Eagle." Long before white men usurped this country, the Indians admired the Eagle and wore his feathers in their head-dresses. They also used them to adorn their pipes of peace.

In this country the Eagle with which we are familiar is the Bald Eagle. He is distinctively known as the American Eagle, and has also been called the Washington Eagle. This bird has plumage of blackish brown, but the feathers of his head, neck and tail are pure white.



His length is about three feet. The Bald Eagle does not reach maturity until he is three years old, and the young birds seem to be larger than their parents, from the fact that their wing and tail feathers are longer than those of the older birds.

The Eagle shuns the haunts of man, preferring the solitude of nature to the society of human beings. Far upon a cliff or in the top of a lofty tree, he builds a nest called an eyrie. It is made of large sticks and branches, bound together with vines, and lined with hair and moss. Sometimes this nest is made to serve for several seasons, and the Eagle improves his property by adding to it every year, until in time the nest becomes a large structure. The mother Eagle lays two or three eggs, white or pale buff in color. Although the Eagle has such a bad reputation abroad, his domestic relations do him great credit. After the young eaglets escape from the shell, the father aids the mother in rearing them with the greatest care, providing them with food and hovering near to protect them from any threatened danger. If a nest robber appears, the old Eagles attack him fiercely, striking at him with their beaks, talons and wings. Taking young birds from an Eagle's nest is a very dangerous enterprise.

When the Eagle thinks it about time the children should learn to fly, he and his mate soar in the air above the nest and try to coax the little ones to spread their wings. If they are too timid to heed the calls, the parents push them from the nest. As the young birds fall, they flutter their wings from instinct, and this helps to keep them afloat. Meanwhile, the mother Eagle flies beneath, ready to catch the Eaglet on her back or in her talons, if he seems unable to fly successfully. The young birds soon learn the power of their wings, however, and are early taught to search for their own food. The Eagle is sometimes seen soaring over waterfalls, keeping a sharp lookout for the fish that are killed by passing over the fall.

As they often pause in the air, hundreds of feet above their prey, it may be imagined with what swiftness they descend to capture it. The Eagle sometimes sees a rabbit leave its burrow and swoops down upon the little creature before it can turn to run for shelter. He boldly seizes hens, chickens, ducks and cats, and will attack and carry off a young lamb or a kid. Many stories have been told of Eagles stealing babes and carrying them to their nests, and while it is possible that such cases have occurred, they are undoubtedly very rare.

A favorite method of the Bald Eagle in securing his food is to rob the Fishhawk. As the latter rises in the air, with the fish he has just caught, the Eagle darts upon him and strikes the Fishhawk a

severe blow with his wing or his beak, which causes the smaller bird to drop his fish. Before it can fall to the earth, however, the Eagle darts downward and seizes it in mid-air. While he flies away to enjoy his stolen meal, the Fishhawk must find another fish for himself.

The Eagle shows some cunning by approaching his prey from behind, so that the sun may not cast his shadow on the ground to frighten the duck or rabbit he intends to capture. He can also fly directly toward the sun, and the strong light does not blind him, for he has an inner eyelid, which he is able to draw over the eye. This lid softens the light, as a piece of ground glass does.

The most famous Eagle in the world was "Old Abe," a name given him in compliment to Abraham Lincoln. Chief Sky, a Chippewa Indian, took him from the nest when he was an eaglet and sold him for a bushel of corn to a man named Daniel McCann. When the Civil War broke out, Mr. McCann carried the bird to Eau Claire, Wisconsin, and presented him to Company C of the Eighth Wisconsin infantry. The soldiers made "Old Abe" their "mascot," and adorned him with red, white and blue ribbons. They carried him to the front and he was present in all of the fifty battles and skirmishes in which the regiment was engaged. He was carried on a perch at the top of a staff, in company with the regimental colors, and although the colors were always the most conspicuous mark for the enemy's bullets, "Old Abe" was never wounded and suffered no greater damage than the loss of a few tail feathers. Singularly enough, too, the color-bearer who carried the flag beside "Old Abe" was never shot down. In battle, the great Eagle seemed to be in his element. He flapped his wings, his eyes blazed and his deafening screams of rage and delight sounded above the roar of the cannon and the rattle of small arms.

"Old Abe" was tethered by means of a cord attached to a leather ring about one of his legs. Once or twice he made his escape, but was coaxed to return to camp. He had his own likes and dislikes among the soldiers. Some of them he would attack fiercely, if they approached him, while others, whom he singled out as his particular friends, were permitted to touch and feed him. He became well known to the soldiers of both armies, and the Wisconsin troops were very proud of him. General Sterling Price, of the Southern army, is said to have declared, "I would rather capture 'Old Abe' than a whole brigade of Yankees."

"Old Abe" served for three years; until his regiment was mustered out. He was then presented to the state of Wisconsin and for many years was kept at the state capitol, in the city of Madison, where he died.



Eagles live to be very old and some are known to have reached the age of one hundred years. They may be kept in captivity, though under these conditions they are much shorter lived than in the free state. The reason of this is probably the loss of opportunity to use their natural powers in lofty flight.

The Golden Eagle is found in all the cold and temperate countries north of the equator. His plumage is dark brown, and the head and neck have tawny feathers, which caused the name "Golden Eagle" to be applied to him. His habits are like those of the Bald Eagle, and he is equally swift in flight and as ferocious in hunting his prey.

## THE VULTURES

THE Vultures are in their own way, very useful birds. As their diet consists almost entirely of decayed flesh, they are natural garbage-collectors,—not a pleasing occupation, certainly, though a very necessary and honorable one. They rarely destroy life themselves, but feed upon the refuse of any kind of flesh. Vultures are found in nearly all parts of the world, though more abundantly in warmer climates. They are among the largest and most powerful of the birds.

The Vulture best known in America is the Turkey Vulture, or Turkey Buzzard, as he is often called. This bird is about two and a half feet in length, and of a rusty-black color. His head and neck are bare of feathers and are covered with a skin of bright red. The bill, which is long and hooked at the end, is white. The feet are very large and have long toes armed with curved nails.

This bird is found in our southern and middle states and as far north as New Jersey, but rarely in New England. When the body of a dead animal is left in the woods or fields it is soon discovered by the Buzzards, which assemble and devour the carrion, picking the bones clean. They also search for refuse and garbage in cities and near the places where animals are killed for food, and remove great quantities of matter which, if left to decay in the open air, would be likely to cause disease and destroy human life. Disgusting as the tastes and habits of the Buzzard are, we cannot deny his usefulness. This is so thoroughly appreciated that in the southern states there are laws to severely punish any person who kills one of these birds. As the birds are never molested, they become very tame and walk about the streets of towns in search of food, or perch on the roofs and chimneys of houses. A person may approach within a few feet of the place where they are feeding before they will move away, and then they









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TURKEY VULTURE.  
1/4 Life size.



usually perch on the nearest tree and wait until the intruder is gone to descend and resume their feast. If a nest or a young bird seems to be in danger from a person or animal, the old Buzzard will discharge the contents of his stomach, which give off so disagreeable an odor that the intruder is almost sure to take to his heels in order to escape it.

The Buzzard makes a nest in a tree, or in the cavity of a stump, though he sometimes selects a bush or overhanging rock as a protection for his home. The female lays two eggs, which are larger than those of a turkey and are white, mottled with purple and brown. If the nest is left undisturbed, the bird will occupy it for two or three seasons in succession.

In appearance, the Turkey Buzzard is not a pleasing creature. His bare head and neck, and long, hooked bill give him a repulsive appearance. At a distance, however, he may be mistaken for a Wild Turkey and it is this resemblance that gives him his name.

An amusing story of a mistake of this kind is told by an army officer connected with the American campaign in Cuba, in 1898: "After the battle of El Caney" he said "and before the advance on Santiago, we were out in the bush waiting for orders to advance. We were nearly starved, for no provisions came up from the ship, although we were maddened by seeing load after load of ammunition go by. Suddenly one of the boys spied a 'wild turkey' in the woods. 'Hurrah' he cried 'we'll have a dinner now.' He slipped into the bushes and in a few moments we heard the report of his rifle. Presently he came back, holding his nose with the fingers of one hand, while in the other he carried a dead Turkey Buzzard. We could not help bursting into laughter, though we felt hungrier than ever, after being disappointed in our expectations of roast turkey. We were all from Massachusetts, and few of the men in the regiment had ever seen a Buzzard before. After that, however, we learned to know them well, for they gathered about our camp in thousands, eating all the refuse that was to be found."

The flight of the Turkey Buzzard is very graceful. He wheels through the air in circles, and floats with the greatest ease, seldom moving his wings until he sees some scrap of food on the ground, when he darts downward at a great speed to seize it. There has been much dispute, as to whether the Vulture detects his prey by scent or by sight. But the evidence offered seems to prove conclusively that both senses are used and both are highly developed in these birds. Buzzards travel in companies and one is rarely seen alone. When several hover in the air over a particular spot, it usually indicates the presence of some carrion on the ground below on which they are



feeding. They are gluttonous birds and sometimes devour so much food at one time that they are unable to rise from the ground until they have partially digested their meal.

The Turkey Buzzard is a harmless bird and may be left to serve us in his own way, at the same time gratifying his own peculiar appetite. It is a beneficent provision of nature that all creatures have not the same tastes, and no doubt we are all thankful to the Buzzard for his most unusual choice.

The Black Buzzard, or Carrion Crow, though not quite so large as the Turkey Buzzard, has similar habits and is an equally useful scavenger. He is found only in the South and rarely north of the Carolinas. While he has no fondness for the society of the Turkey Vulture, he often feeds on the same body and haunts the same neighborhood. His feathers are black, and his head, unlike that of the Turkey Vulture, is dark colored and partially covered with feathers. He does not fly and soar with the freedom of the Turkey Vulture, and when in the air is seen to flap his wings rapidly at short intervals, in order to keep his balance.

The California Vulture, or Condor, is one of the largest birds found in the United States. He appears only in southern California, where he dwells on the most rugged mountain ranges, making a nest on some cliff of rock, thousands of feet above the sea. In general appearance he is like the Turkey Vulture, except that he is larger and has a longer neck. He weighs as much as twenty-five pounds, and the wings measure ten feet from tip to tip. He is a fierce, powerful creature and is dangerous to meet at close quarters. One of these birds which was caught with a lasso was so strong that one man could scarcely hold him.

In South America we find the Condor, which is like the California Vulture. He soars to great heights, sometimes rising above the summits of the lofty Andes. He often reaches such a height that even with a powerful telescope he appears no larger than a robin.

## THE HAWK

THE Hawks and Falcons are all of one family and are among the fiercest birds of prey. There are many species and they are all bold and cruel. They seize their victims with their sharp claws and tear them to pieces with their strong hooked beaks. Their breasts are muscular, their thighs long and brawny, and their feet are armed with long talons or claws, so that they are wonderfully adapted to their mode of life.

Doubtless by most people the Hawk is regarded simply as a robber of the poultry yard. But this is an injustice to some of the family, which number three or four hundred varieties, only two of which are prone to make raids on chicken yards. Many of them are exceedingly useful, as they kill birds or insects which are more harmful.

In the days of knighthood, the nobles took advantage of the blood-thirsty nature of certain species of these birds to use them for hunting purposes. You have doubtless seen pictures of gaily dressed knights and ladies riding spirited horses through the woods or over the fields, and have noticed a rather fierce-looking bird perched on the arm or wrist of one of these noble persons. This was a common scene, especially in England, "when barons held their sway" and when nobles thought work beneath them and even scorned learning. As they had to occupy their time in some way, they devoted much of it to hunting. They sometimes chased the stag or the fierce wild boar, but a more favorite sport was "hawking," or the hunting of wild birds with Falcons.

The Falcon was trained to his work, and every prince and baron had his Falconer, who looked after the breeding and the care of these birds. When ready for the chase, a hood of silk or velvet, often embroidered with gold and gems, covered the head of the Falcon, which perched quietly on his master's wrist. As soon as the hunter spied a bird flying in the air, the hood was removed and the Falcon was tossed upward. Instantly he took up the chase, and, as his rapid flight enabled him to overtake the unfortunate wild bird, he would seize it in his talons and bear it back to his master. The hood was drawn over the Falcon's head again, and when fresh prey was detected, he would be sent in pursuit of another victim.

One of the favorites for this sport was the Peregrine Falcon, which possesses great strength and flies very swiftly. Instead of merely dashing at his prey and grasping it in his claws, he strikes the victim with his breast such a blow as to stun it, before seizing it with his claws. So bold is this species that it was generally employed to take the formidable heron, and the contest was always a spirited one. As soon as the heron was aroused from some marsh, the Falcon was cast off, and in the contest which followed each bird strove to ascend above the other. The Falcon was usually victorious. When high enough, he would swoop down upon the heron and both birds would come to the ground together. The hunter then hurried to the place to aid the Falcon in killing his victim. Sometimes, however, the heron turned his sharp beak toward the Hawk and succeeded in piercing the bird's breast, so that the hunter lost both



Falcon and game. Now that such cruel sport is no longer generally sanctioned, the Falcon is left to hunt for himself rather than for knights and ladies, and to lead his own wild life.

Some varieties of the Hawk are very large, almost as large as the eagle, while others are smaller, yet all have the same bloodthirsty desire to kill. Taking the family as a whole, this love of killing makes these birds useful to men, for they destroy many small animals, like rats, gophers, moles and other creatures, which injure the farmer's crops. It cannot be denied, however, that they kill some birds, often our sweetest songsters.

The Red-tailed Hawk is found in nearly all parts of the United States. He is a large bird, twenty to twenty-five inches in length, with a coat of dull brown that is streaked with gray. His tail is chestnut, colored with a band of black near the end. His nest, which he builds in the top of a tree in the thick forest, is a large crude affair of sticks and is lined with moss and feathers. The female lays from two to five eggs, which are a bluish white, marked with varying shades of red and brown.

Cooper's Hawk and the Sharp-shinned Hawk are the worst chicken thieves of this family. Their plumage is dull blue on the back and white underneath; the breast is streaked with brown and the tail is tipped with white. They are among the fiercest of the Hawks, and although smaller than the Red-tail, they do not hesitate to attack and drive him away from the vicinity of their prey. They are too fond of chickens to please the farmer and are exasperatingly bold in robbing him, for they swoop down and pick out the plumpest chickens in the brood, even when the farmer is but a few steps away.

The Marsh Hawk makes his nest on the ground in the lowlands near the sea. It consists of a loose bundle of hay, with a lining of pine needles, feathers or moss. This Hawk preys on small birds, mice, fish, worms and lizards. He does not soar but moves slowly on the wing and circles above the water and reeds for hours at a time, watching for his prey. In the South he appoints himself a police officer to keep bobolinks away from the rice fields. He is of great service to the planters, for "Robert of Lincoln" likes rice as well as John Chinaman does.

The Night Hawk is often seen in our cities. He is not really a night bird, like the owl, but does most of his hunting in cloudy weather and in the early morning or in the late afternoon. He is sometimes seen abroad on a bright moonlight night. He feeds chiefly on insects, such as beetles, flies, grasshoppers and the moths which fly at night. The swarms of moths that flutter about the electric arc lights attract him to our city streets, but his natural hunting ground

is above a river or field, where insects abound. He is graceful in the air and delights to soar to a considerable height and then dive rapidly downward. This bird does not build a nest but lays its eggs on a flat rock or on the bare ground.

The Sparrow Hawk is the smallest of his family. His coat is reddish brown, with some slate color on the head and wings. He is found throughout North America, though he prefers the South when the frost comes. Instead of building a nest on the ground or in the branches of a tree, he selects a hole in the trunk of a tree. The deserted nest of a Woodpecker satisfies him perfectly. Sometimes he occupies a box that has been prepared for doves, yet he does not molest either pigeons or chickens. He feeds on mice, lizards, grasshoppers and such small birds as the Sparrow.

The Fish Hawk is known in this country as the American Osprey. He leaves to others such prey as birds, mice and grasshoppers, and contents himself with a diet of fish. Every day is Friday on his calendar. He is an expert in catching his prey but often loses it, for the Eagle watches his work and frequently robs him of his freshly caught fish. The Osprey is about two feet in length. His back is brown; his head and breast white or buff. His claws are very large and strong and he has a long beak. He builds his nest in the top of a tree and usually near the water. When bent on catching fish, he circles gracefully through the air, sometimes at a distance of about two hundred feet above the surface of the lake or river. When his keen sight detects the prey rising to the surface, down he darts and splashes in the water like a stone. In a moment he rises with a fish, which may weigh seven or eight pounds, firmly grasped in his talons. He flies away to his nest or to a convenient rock on a hillside and eats his prey at his pleasure. He is found near fresh water in almost all parts of the world, from the arctic regions to the hot countries under the equator. As he depends solely on fish for food, he leaves the colder countries when the ice forms, and flies southward to be near open water.

## THE OWLS

THE Owls are quaint-looking birds, with a very solemn, grave expression. Perhaps their solemn expression gives rise to their widespread reputation for wisdom. In the mythology of the ancient Greeks, Minerva, the goddess of Wisdom, is usually represented as having an Owl near at hand; and the Common Owl of Europe has been alluded to as "the wise Minerva's only fowl."



In Gray's beautiful "Elegy Written in a Country Churchyard," he speaks of the Owl in these lines:

"Save that from yonder ivy-mantled tower,  
The moping Owl does to the moon complain  
Of such as, wandering near her secret bower,  
Molest her ancient, solitary reign."

The Owl figures in various household proverbs, as well as in song and story. "As stupid as an Owl" is a common saying that is really a calumny. The Owl is only dazed by the sunlight, and his manner cannot be charged to stupidity. The proverbial "boiled Owl" is eaten in some countries, and when young, appeals to the palate of many.

There are about two hundred different species of Owl, and they are found throughout the entire world, especially in temperate climates. We have several kinds of Owls in North America alone.

The Owls are birds of prey, closely related to the Hawks, and their sharp beaks and talons are given them for tearing the flesh of animals. Their eyes are so formed that they see best by night, and their feathers are soft and downy, so that they move noiselessly about in the dark and are famous mouse-catchers.

Besides mice and rats, Owls consume great numbers of beetles and other insects, and also eat other birds. Some Owls, unfortunately, are cannibals, and will eat their own kind, if no other food is obtainable. It is not true that they are all poultry thieves. One or two of the larger Owls sometimes catch chickens, but the common or Barn Owl has rarely been known to do so. He often makes his home in the pigeon loft, but does not offer to kill the pigeons. How can we be sure that this is so? In the first place, very careful investigations have been made to determine the character of the Owl's food, by examining the contents of the stomach. In almost every case, it has been found that the chief items are field mice and insects that are harmful to crops. Out of two hundred and twenty-five stomachs of Screech Owls that were examined for this purpose, it was found that only one contained poultry. There is also another means of determining the diet of these birds. Owls are not at all dainty in their eating. They tear their food to pieces, feathers, fur and bones going into the stomach with the flesh. Nature enables them to digest the flesh and then disgorge the fur, skin and bones in pellets. These pellets may be found about a tree in which Owls have a nest. A pair of Barn Owls once lived in a tower of the Smithsonian Institution, at Washington, and their habits were studied by men there, who had made a life study of birds. In the pellets thrown up by this pair of Owls, were found the tiny skulls of four

hundred and fifty small animals, but no chicken bones. Mice formed their staple article of food.

The first thing we notice about an Owl is that his eyes, which are very large and round, are in the front of his head and both of them look directly at us. Other birds cock their heads on one side and look at us with one eye. We see also that he sits very erect, instead of maintaining a more nearly horizontal position, as is natural with nearly all other birds.

The Owl's neck is so formed that he can twist his head around and look directly over his back, and this without moving either his feet or his body. Thus he is able to look for prey or for a suspected enemy, without making any noise by moving from his perch. In nearly all species of Owls, the feet and legs are covered with feathers.

Owls commonly make their nests in hollow trees, and they are quite willing to usurp the nest of a squirrel or a woodpecker. In most cases, their eggs are nearly round, instead of being oval, like those of other birds, and they are invariably white in color. In number they vary from three to six.

These birds usually live in pairs, and the male shares with his mate the household duties by sitting on the nest a part of the time. They take the best care of their young and hunt most assiduously to provide them with abundance of food.

The small birds appear to have sworn eternal enmity to the whole tribe of Owls, and if they discover one perched on a limb, during the day, they often gather in great numbers, taking advantage of the fact that he does not see well in the sunlight, and flutter about him, pecking and screaming at him and trying in every way to make his life miserable. It is their only opportunity for revenge, for at night he makes merciless raids upon them.

The Hawk Owl has a brown coat, spotted with white, and a white face. He is about a foot and a quarter in length and makes his nest of twigs and feathers, on the branch of a tree, rather than in a hollow trunk. He is found in the cold regions of the far North, and rarely, even in winter, farther south than New England. Unlike most of the Owls, he flies by day as well as by night, and makes savage attacks on other birds, and has been known to successfully "hawk" for hawks.

The Snowy Owl is one of the most beautiful birds of this family. He has a very thick coat of feathers, for he lives only in the cold regions of the North. His plumage is often pure white, but is usually dotted with brown or black. He is a large bird, sometimes two feet in length. His nest is made on the ground and consists of twigs



and grass, with a lining of feathers. He utters a peculiar note, somewhat like the growl of a small dog. He is large and strong enough to catch rabbits, birds and even fish, which he seizes with his claws as they come to the surface of the water for their food.

The Screech Owl is common throughout the eastern and middle portions of the United States. This little fellow is but eight or ten inches long, but, unlike the Hawk Owl and the Snowy Owl, has two tufts of feathers back of his ears, which make his head look larger than it really is. Some Screech Owls have gray coats and others have red, and often both colors are represented in one family. They make their nests in hollow trees and sometimes in barns. As a rule, they leave their nests only at night, and if found in the daytime may be easily captured. When they are wide awake, however, they snap their bills viciously at any one who interferes with them. They are interesting as pets and may be kept in the house, in a large cage, or allowed to go freely about the room.

The Barn Owl is another common species. He has a tawny or orange-colored coat, spotted with black and white. The feathers about his eyes are white and are formed like two great disks. In all of the Owls, these face disks are more or less pronounced; they are of stiff radiating feathers evidently to hold back the surrounding down or leave a clear opening for vision. Barn Owls make their homes in barns or church towers, but more often in hollow trees, like others of their kind. When they are forced to leave their retreats by day, they are more or less dazed by coming out of total darkness into broad light, and take refuge as soon as possible in the darkest place of safety they can find.

The Barred Owl, so called because his brown feathers are barred with dull gray or buff, is the famous "Hoot Owl" that makes the noise that resembles the human voice. It utters a cry something like "who-who-oo-ah!" or "who-who-who!" and sometimes make a noise like laughter. Nervous people, who believe in ghosts, have been badly frightened by the calling and "laughter" of Owls in the woods at night.

Besides these we have the Great Horned Owl, whose name is suggested by his very large ear-tufts—he has no real horns; the Saw-whet Owl, whose note sounds like the noise made by filing a saw; the Short-eared Owl; the Long-eared Owl; the Sparrow Owl; and the Burrowing Owl. Owls do not make burrows for themselves, nor do they live with rattlesnakes, as hunters on the western prairies used to declare, but they sometimes appropriate burrows made by other animals, like the rabbit and the prairie-dog, and at the end of it make a nest of grass and feathers, in which to hatch their brood.

Owls should not be molested, for they render good service to the farmer and do him little or no damage. If, however, you set out to capture a pair of them to keep as pets, remember that they defend themselves bravely with their sharp beaks and claws. If you can surprise them in the daytime, perhaps they will only blink and allow themselves to be taken without any resistance.

## THE KINGFISHER

THERE are many birds of the Kingfisher family to be found in different parts of the world, but the only one with which we are familiar in the United States is the Belted Kingfisher. His plumage is a slaty blue, the tail and wing feathers flecked with white, and his breast is crossed by a band of blue, while the female and the young birds show also a light chestnut band on the breast. On the head is a ragged crest.

The Kingfisher does not fear the cold, but needs open water for his fishing operations, and when the ponds and rivers freeze in the north, he goes southward to remain until the ice is broken up in the spring. He usually selects a tree-limb projecting over the water as a perch from which to watch for fish. When he sees his prey in the water, he darts swiftly down upon it, seizes the fish and returns with it to his perch. Sometimes he jerks the fish into the air, and then swallows it before it can reach the water. He bolts his food greedily, bones and all, and later, when digestion has been completed, he expels the bones in pellets, just as the owl does. The Kingfisher's plumage is very compact and the feathers are covered with an oily secretion applied by the bird with his bill. This makes his covering waterproof, so that he suffers no discomfort from plunging into the water to catch fish.

The Kingfisher does not build his nest in a tree, but digs a hole in the bank of the river or pond where he is accustomed to fish. Sometimes this hole is made in a sandbank and at other times in more solid earth. The opening is only large enough to admit one bird at a time, but inside is a larger cavity, which affords room for both the parent birds and the young Kingfishers, when they are hatched. The female lays six or eight eggs, white and glossy and an inch and a quarter long. The nest has no lining and the eggs rest on the ground of the little cave which serves as a nest. Kingfishers are not inclined to keep their nests tidy, and the refuse of fish gives the place an unbearable odor.



The Kingfisher's brilliant plumage makes him a handsome bird, but his cry is harsh and grating. When his nest is approached, he screams angrily, and at the same time raises his crest and jerks his tail back and forth, and will fly about the intruder endeavoring to frighten him away.

The Ancients had many superstitious ideas regarding the Kingfisher of their country. His nest is usually well-concealed, and as they were not close students of the habits of birds, they believed that he built his nest upon the surface of the water, and that while the young birds were being hatched from the eggs, the sea remained calm, in order that they might not be disturbed. They called the bird the "Halcyon," and from the fact that during the nesting season the waters were usually calm, they referred to that period of the year as "Halcyon Days." We often speak now of happy and successful periods in our lives as "Halcyon Days," but few of us ever stop to ask just what "Halcyon" means or why the term is applied to our times of prosperity. So we see that the Kingfisher has taught us something and that he has been well known to man for many centuries.

### THE AMERICAN BUTCHER-BIRD

THE Butcher-bird receives his name from the manner in which he handles his prey. Besides insects, he eats other birds; and is in the habit of hanging his victim on a thorn or twig, where he can cut it up and eat it at leisure, just as a butcher hangs upon hooks the slaughtered bodies of hogs and cattle.

The Butcher-bird's other name is Northern Shrike. He has a southern cousin called the Loggerhead Shrike, and these two species are the only birds in America known to hang up their prey in "butcher" fashion. In some parts of the world, however, there are many birds that follow this custom.

The Northern Shrike has a coat of bluish gray. His wings and tail are black, tipped with white. His breast is grayish white, penciled with darker gray, and he has a black bar on the side of his head. He is about ten inches in length. His bill is hooked like a hawk's and is very powerful, but his feet are small and weak, so that he does not use his talons for seizing prey, as the hawk does, but depends solely on his strong bill. His prey, however, is not so large and difficult to manage as the hawk's, for while he does occasionally kill robins and sparrows, his principal food is the larger insects, like grasshoppers, spiders and crickets. He is constantly

seeking new victims, and as he kills more than he can eat at one time, he hangs the grasshopper or the sparrow on a sharp thorn for future need. When his appetite returns, he goes to his storehouse and selects his food.

The Butcher-bird is bold and fierce and has been known to enter the cages of tame birds and kill them, even when he could not carry off his prey. He is something of a mimic and will imitate the calls of the songbirds, in order, it has been said, to draw them within his reach. His call is harsh and unmusical, but he plagiarizes the notes of various other birds, and, weaving them together, sometimes sings a passable song.

This bird is a hardy creature and breeds as far north as the arctic circle. In the winter, he moves as far south as Maryland and Ohio, but early in February or March, returns to the north.

The Loggerhead Shrike, the Butcher-bird of the Southern States, is a little smaller than the Northern Shrike and has a black forehead and white breast. The nests and eggs of these birds are alike. The nest is a rough structure of twigs and grass and is lined with feathers or leaves. The eggs vary from four to six in number and are gray, tinted with green and spotted with brown and purple.

Although both the Shrikes are cruel birds, they promote the interests of the farmer by destroying insects, as well as mice and small snakes. If they did not destroy other birds, we should have no serious charge to bring against them.

## THE RAVEN, THE ROOK AND THE JACKDAW

IN OLDEN times, the Raven was supposed to possess the gift of prophecy. His portentous croak and coat of mystic black give him rather an oracular bearing, and he is surrounded with a network of superstitions. Edgar Allan Poe in his favorite poem entitled "The Raven," says:

" 'Prophet!' said I, 'thing of evil!—prophet still, if bird or devil!—

\* \* \* \* \*

Is there—is there balm in Gilead? Tell me! tell me, I implore!

Quoth the Raven, 'Nevermore.' "

Our oracle so closely resembles the Crow, to whom he is nearly related, that many who are not familiar with both, easily mistake one for the other. The Raven is the larger bird, however, for while the Crow measures from seventeen to twenty inches in length, the Raven



often reaches a length of twenty-seven inches. He is, in fact, a large and powerful bird, and has even been known to attack weak lambs, while squirrels, rabbits and other small animals are easily overcome by him.

One or other species of Raven is found in almost all parts of the northern hemisphere. He is common in England and in the Scandinavian Peninsula. In the United States, the American Raven is seen west of the Mississippi River oftener than in the East.

This bird does not always build his nest in a lofty tree, as the Crow does, but chooses a rocky cliff that is not easily reached by man. Sometimes he nests in the walls of a ruined building, where no one is likely to disturb him. The nest is compactly built of sticks and grass, and is lined with hair or wool. From three to seven eggs are laid. These are of a pale olive color, marked with brown, and are about two inches long.

In his family affairs, the Raven is a model. When the female is sitting on her eggs, the male keeps her abundantly supplied with food, and does not neglect her for a moment. The parent birds take the best of care of their young, and the little Ravens remain near for a fortnight before they are taught to provide for themselves. The mother bird prepares their food in her own crop and pumps it down their throats, until they are old enough to digest their own food. When they begin to fly, the young birds accompany their parents during the day and return home with them at night, like dutiful children. When hatched, the young Ravens have dark gray plumage, which changes to glossy black as they grow older.

Ravens live together in small communities, but never have extensive roosting-places in woods, like the Crows. They prefer rocky ledges and leave them for the lower ground only to obtain food. Grain, fruits and insects, as well as small animals, furnish the Raven his food, and he is a carrion-eater, like the large birds of prey. He bolts his food in large pieces and afterward disgorges the bones and skins of animals or the stones of fruit which he has eaten.

The Rook and the Jackdaw are members of the Crow family not found in America. The Rook is about the size of the common Crow and at a distance is easily mistaken for him. The habit of this bird in nesting in great numbers about any suitable place has given the name rookery to an old building that swarms with human occupants. The Jackdaw is another European bird. He is much smaller than the Crow or the Rook, being but thirteen inches long. He fancies old ruins and deserted chimneys as nesting places. Jim Crow's reputation for thieving is also shared by this bird.

## THE COMMON CROW OF AMERICA

THE Crow bears a very unenviable reputation as a rogue, still his habits are interesting to study. His strident "caw caw," which he screams out while flying through the air, is not very alluring, yet he plays many variations on that note when conversing with his fellows in the rookery. With his glossy black plumage and bright black eyes, Jim Crow is really as "black as he's painted" in both the literal and the figurative sense. He is found in all parts of the eastern United States.

During the nesting season, Crows are found in pairs in little groups of six or eight. Jim Crow always builds on the topmost bough of a very high tree bare of lower branches, which does not offer an easy task to the climber who would rob the nest. The nest, which is huge and clumsy in appearance, is built of sticks and twigs, and well lined with grass and other soft material. He earns his reputation as a thief by his habit of helping himself to ribbons that may be left within reach, lace pocket handkerchiefs from the clothesline, or any other convenient stuff that will serve as a lining for his nest.

Crows never build their nests near those of other birds. In winter, they assemble in thousands in some favored locality where there are lofty trees, and these "rookeries" often cover several acres in extent. There is a resort of this kind on the bank of the Potomac River, near Arlington, but a short distance from the city of Washington, D. C. During the day, the birds go abroad in search of food, but at night they return to the rookery and chatter among themselves with the greatest excitement, as they apparently gossip over the news of the day. As they fly from one point to another, they form such compact ranks that they seem like a black cloud against the sky.

The Crow has a tremendous appetite and he cannot be called dainty. He eats insects, worms, fish, fruits, nuts, the decayed flesh of animals, and other birds, whose eggs he also steals. He is smart enough to catch clams and drop them from the air on a rock, in order to break the shell and enable him to get at the meat inside. Sometimes he attacks and kills young ducks and chickens, rabbits and squirrels. In short, almost anything that is eatable and can be taken by stealth or force, may find a place on his bill of fare.

The Crow has enemies in birds like the Eagle and the Owl, which rob him of his prey, yet he has most reason to fear the farmer to whom he gives much annoyance. As soon as the corn begins to sprout, the Crow descends on the field and deftly pulls up the kernel by the tender shoot that appears above the ground. Some of the



Crow's friends have tried to defend him by declaring that when doing this he is only looking for the grubs and worms which might destroy the corn, but unfortunately he is very fond of the swelling kernels of corn. It must be said to his credit, however, that he destroys an immense number of cutworms, beetles, grasshoppers and other injurious insects which do the farmer more harm than the Crow does. When Crows assemble in large numbers, they often become a serious menace to the farmer's crops and with the aid of gun and trap he kills as many as he can. Scarecrows have been much used to frighten these birds from the cornfields. Yet they are shrewd birds and are not easily deceived by such tricks. They have been known to perch derisively on the head of one of these images instead of being struck with terror at sight of it.

Stories have been told about tame Crows which learned to talk, but the bird's abilities in speech-making are very limited. The cruel practice which formerly prevailed of slitting his tongue, in the belief that it enabled him to speak like a human being, is unworthy of an enlightened age.

A young Crow may be tamed without difficulty, and will remain about his owner's house without showing any disposition to leave for the woods. When his food is provided for him, he devotes all his energies to mischief. He delights to tease the cat by tweaking her tail as she lies asleep, and to worry the dog by riding upon his back. "Jim Crow" is a born thief, and amuses himself by hiding little articles which belong about the house. If a pair of spectacles is laid on the table, the crow watches for a chance to steal them, and perhaps drops them behind the sofa. A lady who kept a tame crow had a servant who had been with her for many years, and whose character was above reproach. The lady missed several articles of jewelry and finally suspected the trusted servant of taking them. The thefts continued and the loss became so serious that the servant was charged with stealing. She wept and protested that she was innocent, but when her room was searched, a part of the missing jewelry was found there, concealed behind the dresser. The servant still declared her innocence and although she was told that if she returned the missing articles she would be forgiven, she said she never had taken them and did not know where they were; so she was discharged. The next morning, the lady of the house missed a valuable brooch which she had left on her bureau. There was no clue to the thief, but later in the afternoon her husband saw "Jim Crow" perched on a tree near the house with a gold ring in his beak. He watched the bird, and presently the crow flew to a toolhouse in the garden and dropped the ring in a flowerpot. Then he flew back to the house





CROW.  
½ Life-size.

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From col. Chi. Acad. Sciences.

CATBIRD.  
 $\frac{3}{5}$  Life-size.

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and entered the open window of the servant's room, from which he soon came with another ring. This also he took to the toolhouse. The mystery was solved. So slyly had the crow carried on his thefts that no one had noticed that he was engaged in mischief. All the stolen articles were recovered, and the lady sent for her servant to come back, but the latter felt deeply wronged and refused to return, so that the lady lost, as she said, the best servant she ever had.

This is only one example of the clever tricks of the tame crow. He is an amusing bird, and if he were not a thief would be highly respected. As we cannot suppose the Crow steals articles because of their value, we may believe that his fancy is pleased by bright objects, and he hides them away so that they may not be taken from him.

### THE CATBIRD

THE Catbird and the Mocking-bird are related. The Catbird is a mimic as well as the latter, and is so named because one of his favorite vagaries is to imitate the mewing of a cat. He can mimic the notes of other birds, too, and the harsh and spiteful call, like the noise made by a cat, is a strange contrast to his rich and varied song. He struts about pompously while singing, and his whole attitude is one of self-conscious vanity. He is not a peacemaker by any means, and quarrels with other birds upon the slightest pretext.

The Catbird has a slate-colored coat, with black cap and tail, and under his tail appears a spot of chestnut color. He is not afraid of man and often builds his nest in the garden trees or the shrubbery about the house. It is quite a large nest, made of grass and leaves, interlaced with twigs, and lined with fine roots or grass. The eggs are a deep, clear, greenish blue, five or six in number.

Worms, beetles, caterpillars and other insects are his chief food, but he helps himself plentifully to the cherries, strawberries and other fruits in the garden. He does not eat hard seeds.

Like our robin, our Catbird is fond of water, and seems to think that the sprinkler on the lawn is a sort of public bath. He is often seen fluttering under the falling spray or splashing in the little pools.

He is a courageous bird, and if other birds or persons approach his nest, he will cry at them harshly and angrily, making threatening motions. He even attacks snakes which approach to steal the eggs or to devour the young birds.

The Catbird winters in the South, and is seen in the North from April to October. He always announces his arrival so noisily that we know when he has taken up quarters near us for the summer.



## THE BLUE JAY

THE Blue Jay belongs to the interesting family of crows, and his harsh, rasping note of "Jay! Jay!" is no more musical than his relative's "Caw! Caw!" But he has a great variety of notes, some of them quite musical, and utters them so persistently that one might think there were ten times as many Jays as there really are. Like all small birds, he has a deep dislike for the owl, and loses no chance to scold and torment him, whenever he can do so in safety to himself, that is, in sunlight, when the owl is at a disadvantage.

Indian corn, cherries, apples, chestnuts, acorns and grasshoppers furnish him a varied bill of fare, but he does not hesitate to prey also upon the small birds, eating their eggs and young. The ruthless fellow is sometimes interrupted in his cruel work by the brave king bird, who puts him to cowardly flight; and even the robin often drives the Jay from the field.

The Blue Jay is not retiring in his disposition. He steals the farmer's fruits and vegetables, and builds his rude nest near his dwelling. Though the structure of his nest is crude, it is strongly built of twigs and roots. The eggs are four or five in number, of olive green or buff, spotted with various shades of brown.

The Blue Jay is found in all parts of the eastern United States, from Florida to Canada. He remains in his chosen locality throughout the year, unless a severe winter impels him to make a temporary change of residence, in order to find food. He is not fitted for long flights, being slower and less graceful on the wing than his relative, the crow. In outward appearance he is very handsome, with his bright blue plumage barred with black on the wings and tail, which are tipped with white. His throat and breast are pale gray, sometimes almost white, and he wears a black collar across his neck. If kept in captivity, he is somewhat subdued, but shows some of his characteristics in imitating the calls of different animals. This he does so perfectly as often to deceive.

The Canada Jay is a cousin of the Blue Jay. He has a gray coat, with a black cap, and his under parts are gray. He has a rather ragged and frowzy appearance, and is far from being as handsome as his cousin in blue. In his habits he is much like the latter, however, for he quarrels and steals as much and as boldly as the Blue Jay. This bird is found only in the northern tier of the states and in Canada. The hunters call him "Whisky Jack" or the "Moose Bird." He is so bold that he does not hesitate to steal food from the hunter's tent and is sure to carry off any scraps that he may find about the camp. He annoys the trapper by stealing the bait from his traps,

and he also feeds upon the animals he finds dead in the traps. For the winter, he stores away nuts, berries, scraps of meat and other articles of food, and, thus supplied, he continues his house-keeping, even through the severest weather. His nest is well sheltered in the thick branches of a pine or fir tree, and the eggs are laid, and the young birds hatched, before the snow is off the ground.

The Rio Grande Jay is found along the lower Rio Grande. His coat is green, with blue and yellow tail-feathers, and a blue crown on his head. His throat is black. This bird's habits of feeding, his disposition to fight and his nest and eggs are much like those of the northern Jays.

Another species is Stellar's Jay, which is found on the Pacific coast northward from California. He has darker plumage than his eastern cousin; his breast is blue, instead of gray, and his head and crest are nearly black. The eggs are pale green, spotted with brown.

Noisy and quarrelsome as the Jays are, their lively movements and bright colors make them attractive, and if it were not for their persecution of smaller birds, we could forgive them their bad habits of pilfering. It is not to be forgotten that they eat grasshoppers and insects and so make some amends for the fruit they spoil.

## THE MOCKING-BIRD

THE Mocking-bird is the "star" of nature's feathered opera troupe. He is a most versatile genius, and, besides charming us with his original melody, he is a great mimic. He imitates, when he wishes, the notes of other birds, whistles like a boy, clucks like a hen or whines like a puppy. He is a professional musician, and is in his natural element when singing. He so overflows with melody that he sings at night as well as during the day.

This famous songster is common in the southern part of the United States and is found as far South as Brazil and sometimes, but rarely, north of Virginia. He builds a nest of twigs, roots and grass in a thicket or cluster of stunted bushes, and the female lays from four to six eggs, which vary in color from greenish blue to pale buff, marked with spots of brown.

The Mocking-bird has not a gaudy coat, like the parrot, but he is a delicate, graceful bird, with a long tail and a full throat. The prevailing color of his plumage is gray, with white tinged with gray, underneath. His bill and feet are black.

In the winter the Mocking-bird lives on berries, and when spring comes he changes his diet to insects and their eggs, worms and grasshoppers.



The Mocking-bird has a friendly disposition, but when at home during the nesting season, he is always on the defensive. He is very valiant in protecting his young from any threatening peril. If a cat or dog, or even a man, approaches his nest, he flies at him, screaming defiantly. The greatest menace to his family is the black-snake, which watches for an opportunity to rob the nest of either eggs or fledglings, as the case may be. If the Mocking-bird spies the enemy coming, however, he attacks him, pecking at his head and eyes and evading the charm that snakes are supposed to exercise over birds. Very often his snakeship is compelled to retire, while the Mocking-bird mounts a bough and sings his song of victory. When he goes abroad and feels no responsibility for his young, the Mocking-bird is most affable. He shows no fear of man, coming into the dooryard to serenade his human friends in ringing notes. He regards the cat and dog as his natural enemies, and quarrels with them whenever they appear.

The Mocking-bird's vocal powers are marvelous. He has a song wholly his own, but in addition to that he borrows the notes of other birds, weaving them together in a harmonious medley. When he sings, his great joy impels him to hop about from place to place. He takes short flights in the air and spreads his wings and tail, as though himself intoxicated by the sweet melody pouring from his soul. He is a shrewd and intelligent bird and seems to delight in imitating the calls of other birds for the purpose of deceiving them. Thus he will sound the harsh note of the hawk, and send the chickens scurrying to cover under their mother's wings, or answer the plaintive call of the whip-poor-will or the call of the catbird until the deceived birds come to find him, thinking their own mates are calling them. In the midst of his song he frequently stops to whistle and his whistle is the envy of every boy, for it has a liquid sweetness rather than a shrill tone. He can imitate the whistle of a dog's master so that Rover will come running to see what is wanted of him, and then Sir Mischief apparently enjoys the joke that he has played on his four-footed enemy.

In the night, when there is a bright moon, he often perches on the topmost bough of a tree or on the chimney of a house and bursts into glorious song, which seems doubly sweet in the stillness of the night.

The Mocking-bird is often caged and he seems to have "a heart for any fate," for he sings joyously, even in captivity. But when he has grown to be six or seven years old, he is apt to become blind, and as soon as he is deprived of the sunlight, his courage fails, he becomes unhappy and soon dies.

Young Mocking-birds are often taken from the nest just when they are ready to leave it and put into a cage. They have not known





FROM COL. F. M. WOODRUFF.

AMERICAN MOCKING BIRD.  
 $\frac{2}{3}$  Life-size.

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WHIPPOORWILL  
 $\frac{3}{4}$  Life-size.



freedom and do not pine for it as the older ones do when they are captured. After the young birds are placed in the cage, they are sometimes left out where the mother finds them and feeds them. This, however, is not a very safe plan, for the mother sometimes seems to feel that a great calamity has befallen them and evidently thinks it better they should not live at all than to live in captivity, and so gives them some kind of poison food.

In the South, where he is most common, the people are very fond of the Mocking-bird and he is seldom harmed by them. He has no bright plumage to tempt fair ladies, so cruel fashion exacts no tribute of life and silenced melody from the most brilliant songster of the South.

### THE WHIP-POOR-WILL

THOSE living in the eastern part of the United States are familiar with the plaintive call of the Whip-poor-will. Few, though, have ever seen him. He reverses the maxim of being seen and not heard. Lying closely in cover during the day, he flies about by night, usually in one locality, and catches the moths and other insects which form his food. At intervals he repeats his mournful request for the punishment of "Poor Will." One of our poets prettily describes the habits of this minstrel of the night in these lines:—

"He shuns the crowded haunts of men  
And hies to forests far away—  
Or seeks some deep, secluded vale,  
To pour his solitary lay,—

"Or, haply at some cottage door,  
At fall of night, when all is still,  
The rustic inmates pause to hear  
The gentle cry of 'Whip-poor-will.'"

During the day he secludes himself in the woods, and you might pass close to his low resting place without observing him, for his mottled coat blends effectually with the colors of the ground. Should you ever be so fortunate as to spy him, you will notice at once the collar of white feathers about his neck and the many long bristles about his mouth.

These bristles are characteristic of the family to which the Whip-poor-will belongs. The ancients called all members of this family Goatsuckers, because they often saw them alighting on their goats. In reality, the birds were attracted to these animals only because of



the insects in their hair or wool. The name thus given to them through a mistaken notion, still clings to the family.

The Whip-poor-will's call is heard in the North from early in May to the middle of September. He spends his winters in the South, where he has a near relative known as "Chuck-Will's-widow." This name is also derived from the fancied resemblance of his call to these words. In the South, therefore, during the winter season, you may frequently hear both these birds at once. While one is saying "Whip-poor-will," the other is repeating constantly "Chuck! Chuck! Chuck! Chuck-Will's-widow!"

The effect is striking and sometimes becomes unpleasant to nervous people who are trying to sleep, for the birds often remain for hours about a single clump of trees or bushes, and their clear notes can be heard for a long distance.

The Whip-poor-will, like other species of his family, is shiftless in his domestic habits. He never takes the trouble to build a nest. The female simply scrapes a few leaves together on the ground, and there she lays two eggs, white or pale buff, marked with brown and lilac. This apology for a nest is seldom disturbed, for it is always in the thick woods.

## THE BOBOLINK

**I**T costs the rice-growers of the South vast sums of money each year to entertain the Bobolink. So fond of rice is he that the Southern people call him the Rice-bird. In the Middle States he is known as the Reed-bird, and in the North more familiarly as Bobolink. "Bob-o-link! Bob-o-link! Chink, chank, chink! Bob-o-link! Bob-o-link! Chee, chee, chee!" he says loudly and cheerfully. He is a merry bird and puts his heart into his song without restraint.

The Bobolink winters in South America and the West Indies. In Jamaica, where he grows very fat, they call him the Butter-bird. Sometimes during March he gets as far north as Florida, and from that time forward he gradually moves toward Canada, reaching the Northern States in May. The male birds usually arrive in advance of the females and when the latter appear, the mating season begins at once. The male birds have many lively quarrels over their mates, and it is during this time and later, when the female is sitting on the eggs, that the Bobolink pours out his sprightly song. Sometimes he perches on a bush or tree near the nest and sings to cheer his mate; again he soars in the air, singing as he flies, like the skylark. When the nesting season is over, he is less tuneful and his song becomes a series of noisy chirps, or ceases altogether.

The male Bobolink has a coat of black, with buff on the back of the head and neck, and white on the rump and above the wings. In winter his coat becomes yellowish brown, streaky, and less conspicuous, like that which the female bird wears all the year. The white eggs have a buff or green tint, and are spotted with brown and purple, and number from four to six. Mr. Bobolink is so busy practicing his songs in the mating season, that he leaves the building of the nest chiefly to his mate. It is a small plain nest of grass, placed on the ground in a meadow.

In the Spring, the Bobolink eats grubs and insects, such as grasshoppers and spiders, and when the grains are ripe, he finds oats, barley and rye to his liking. Among the seed crops, rice is his favorite food, however, and he eats not only the cultivated rice in the South, but the seeds of the wild rice that grows along the borders of streams and marshes farther north.

Although he is a small bird, his flesh is toothsome, and under the name of Reed-bird he often appears on the bill of fare in fashionable hotels and restaurants.

## THE BLUEBIRD

YOU may always know that spring is at hand when you see flitting specks of blue amid the dull tints of the barren branches of the trees and of the brown earth. The Bluebird is one of the first harbingers of the awakening season, and in some localities appears even before the robin. At first he flits from place to place, absorbed in the duty of house-hunting. Every hole in a building or sheltered crevice in a tree is a possible dwelling-place for him. Yet he prefers a cosy nook about the barn, or a box, such as many people who are fond of birds, place in their yards and gardens. Once the Bluebird was as fond as the robin of city life. A snug box provided for his use was sufficient to induce him to make his nest in any dooryard close to a busy street. But the English sparrow, who is his worst enemy, has compelled him to retire to the country, where he can lead a more peaceful life.

Early in April, he and his mate settle down to housekeeping. They are not at all particular as to their surroundings. The nest is soon set in order with a lining of grass and feathers. Then the female lays her eggs. They usually number four or five, and may be either pale blue or white.

While the Bluebird is a peaceable little fellow, he sometimes shows great courage. If a rival comes to chatter with his mate, he becomes very jealous of the intruder and flies at him fiercely. At such times



he utters a shrill cry of protest. He is known to successfully defend his nest against much larger and stronger birds. Yet he is not always as good as he should be, for he sometimes drives the swallows from their nest and takes it for his own.

He does not hop about on the ground as much as the robin does, but darts from tree to tree. Occasionally he flies to the ground to pick up a fat worm or a sprawling beetle. He is also fond of grasshoppers and spiders in their season, but in the autumn and winter he makes his meals of berries and the seed of plants.

He sings both when in flight and at rest. He is not a brilliant songster, though he warbles his sweet simple notes with great spirit and seems to be always happy. When the female is sitting on her eggs, he sings less frequently and in lower tones. Naturally he is very busy at such times in procuring fat worms and other delicacies for his little mate. In the late fall, his notes seem quite plaintive, compared with those with which he welcomes the springtime. When we hear his warble on some pleasant November morning, the burden of his lay seems to be "Farewell."

The male has a bright blue coat, with a darker shade on the wings and tail. His breast is reddish brown, as if copied from the waistcoat of the robin. The shafts of his tail and wing feathers are black, and underneath is white.

Bluebirds are never seen in very large companies. They are very faithful to their mates, and, unless disturbed, the same pair will return to a favorite nest season after season. They rear two or three broods during a season, and are so fully occupied with their duties, that they linger in the North till snowflakes fill the air. They spend the midwinter in the Southern States and in Mexico. Some, it is said, fly even to the Bermudas and the Bahama Islands.

The Mountain Bluebird is found in the far western states, among the Rockies. Except in winter, he seldom visits the lower lands. With him, pale blue feathers take the place of the red on the breast of his eastern relative. He has much the same habits as the latter, though the Mountain Bluebird is shyer and less inclined to sing.

## THE ROBIN

"THE first Robin!"

"Where? where?"

"There on the grape-vine trellis!"

"Then spring has come at last."

He is an early comer, this red-breasted friend of ours, and we watch eagerly for his appearance as a sign that winter is gone,





BLUE BIRD.  
Life size

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ROBIN.  
Life-size.

though spring is only at the threshold. The American Robin is not the Robin Redbreast so dear to the hearts of English children and so often written about, but he is none the less welcome among us. He is really a thrush, larger than his English cousin, and with a less brilliant waistcoat.

From Hudson Bay, in the cold north, to Mexico, he ranges, but he is a hardy bird and sometimes, if the winter is a mild one, remains in New York and New England throughout the year. In Virginia and farther south, he is found regularly during the winter. He returns to the Northern States early in March and by the middle of April begins to make his nest. This is a rather large affair, made of twigs and grass cemented with mud. Usually he builds it in a tree, not far above the ground, and without much concealment. At other times he builds on a fence-rail, or in a corner of the porch, for he is a fearless bird and does not shun the society of people. The mother Robin lays four or five eggs of greenish blue, and raises two, and sometimes three, broods during the season.

Robin's coat is olive gray above, with dark feathers on the head and neck—sometimes almost black. His tail is dark, with the outer tail feathers tipped white. His throat is white, with streaks of darker feathers, and his breast is brownish red. The color of the breast varies, however, from a pale chestnut to a warm brown that is almost red.

The Robin is the proverbial early bird that catches the worm. The first hint of daylight from the eastern sky finds him abroad, looking for worms and insects. How boldly he hops along, looking keenly in the grass for tiny bugs. A quick dart of his head and he has a fat worm squirming in his beak. Away he flies to the nest to share it with his mate, and soon returns to look for more. It is pleasant to see him so confident that he will not be molested. If we keep very quiet, and scatter a few crumbs on the floor of the piazza, he will even come close to our feet, a few hops at a time, and greedily devour the crumbs. He is not so easily alarmed, and even if he is followed, will hop along on the ground just out of reach, for some distance, before he takes wing.

In the early morning, the Robin sings his cheerful carol, usually before most of us have left our beds. Mounting on a swinging branch, he pours out his simple song, not in a brilliant medley like the oriole, but a hearty, earnest melody full of the joy of living. As the day wears on, he is so busy seeking food that he has no time to sing, and you will hear lazy people, who like to lie in bed late, declare that he never sings. They would not belittle his musical talent, if they would rise as early as he does and listen to his greeting to the rising sun.



The little Robins inherit from their parents a tremendous appetite. Have you ever seen them in the nest—quivering, naked little things, with their mouths stretched wide open, all clamoring for worms? Watch the Robins when they build near by in the spring and you may be able to see into the nest by simply pulling down gently the low branch on which it is placed. You will see the bluish eggs, and later the four or five clamorous little birds, with their shrill “Peep, peep”; then, as they grow larger, and their feathers come, they will crowd the nest so that there is danger of their falling out before they are able to fly. Watch the old birds as they call excitedly to the little ones, coaxing them to spread their wings; and finally you will see them fly away. When autumn comes, and the last brood has gone, you may take the nest, if you will, for a souvenir of your feathered friends. And while you are watching the busy, happy birds, remember that Puss is also watching them, for she thinks it great good fortune to catch a fat Robin for her dinner, so you may need to drive her away from the vicinity of the nest. A lady in Massachusetts was very much delighted when a pair of Robins built a nest under her window. The nest was on a low tree and as there were several cats in the family, she feared for the safety of her feathered neighbors. To make them secure, she placed around the trunk of the tree, as high as a cat would jump, a wide band of wire netting, opening downward and outward, like an inverted umbrella. The cats soon saw the Robins and watched them with hungry eyes, but they could not get beyond the wire netting. As the Robins were thus secure from harm, they remained throughout the season, raising two broods of little ones, and all through the summer the lady could look into the nest, which was only a few feet from the window. With her camera she obtained a series of pictures showing the eggs, the mother bird sitting on the nest, the father bird bringing worms to feed her, the hungry little ones with their gaping mouths and all the details of Robin life to the end of the season. The birds knew that she was near them, but they were so sure she meant them no harm, that they attended busily to their own affairs and lost no time in worrying. It is a pity that all the feathered creatures cannot feel the same confidence in us. If so many were not trapped and shot, perhaps all would be more neighborly.

Insects and worms are the Robin's food, and in summer he also helps himself to our cherries and strawberries. Sometimes we think he takes more than his share, yet we should recall his service in destroying insects. He gets credit for some thefts of which he is not guilty. The writer had a thriving strawberry patch, in his garden, and the Robins occasionally took a juicy berry. One day a large toad was noticed sitting near a strawberry plant. He was there to catch

insects, of course; but presently, when all was quiet, his big mouth opened, and lo! the largest strawberry in the patch had disappeared down his throat. He gave only one gulp and continued to look very solemn and innocent. But it may be that he had been the real thief in the strawberry patch, instead of the Robins. In winter, when the insects are not abroad and the worms have burrowed deep in the ground, the Robin feeds on buds and berries.

The quarrelsome English sparrows have killed and driven away many Robins, in our large cities, but the Redbreasts are still numerous, and we hope they will always feel as much at home with us as they do now.

## THE THRUSHES

THE Thrushes, with their sober plumage and shy, gentle dispositions, are among the sweetest songsters in America. Their songs are not characterized by the enthusiasm of the Mockingbird, or the buoyancy of the Catbird. Yet their clear musical notes, so tender and melodious, have a greater power to charm than the more spirited outpour of other birds.

The Wood Thrush has a dark brown coat, with tints of olive, becoming reddish on the head, and his breast and throat are white, with brown spots. In summer he is found in the eastern United States, and remains north until late in October, when he flies southward to stay until the following April. This bird is shy, and yet haunts our gardens and the suburbs where shade trees abound. His nest is usually built on a low branch not far from the ground, and is made of leaves and grass, cemented with mud and lined with softer material. The pale blue eggs are three or four in number.

The Veery is also called Wilson's Thrush. He has a much lighter coat than the Wood Thrush, sometimes of a reddish cast. He builds his nest on the ground, in the grass or near the foot of a tree. Grass and weeds are used to make the nest, which blends so perfectly with its surroundings that it easily escapes notice.

The Veery dwells in shaded woods and thickets, and preferably on low ground near a stream. He is very shy, rarely coming out into the open, where he may be plainly seen. His call is a clear, quaint whistle which sounds something like "Vee-ree, vee-ree," and from this comes his name. He sometimes sings in the night, when his mystic notes thrill the silence of the woodland with a peculiar sound.



The Hermit Thrush was so named because he is seldom in the company of other birds, even of his own family. Like the other Thrushes, he lives in the deep woods and feeds on insects. Bushy swamps and damp woods are his favorite dwelling-places, and he makes a nest of moss, grass and leaves on the cool ground. His coat is brown, with reddish tail, and his white or buff-colored breast is marked with triangular brownish olive spots. His song is a succession of low, tender notes, almost solemn in tone.

The common Water Thrush, or Wagtail Warbler, is usually to be found in the neighborhood of a swamp or stream. He wades in the shallow water, on the lookout for insects which fly near the surface. His nest is made of roots, leaves and grass, and is placed on the ground, often in a bed of moss. His song, which is very sweet and melodious, is rather more sprightly than those of other Thrushes, being more like that of the Warblers, to which he really belongs.

The Brown Thrush or Brown Thrasher, is much larger than the Thrushes previously mentioned. He has a bright reddish-brown coat, and his breast is spotted with blackish brown. He has a bill almost as long as his head, and his tail also is conspicuous for its length. While he is a shy bird, he is very active and full of spirit. He sings loudly and sweetly from a perch high in the top of a tree. His nest is made of twigs and grass, lined with feathers or horse hair, and is placed on the ground or in a bush. Berries, snails, worms and grubs, beetles and other insects satisfy his appetite in summer, and in winter he eats the hard berries of shrubs and trees.

All the Thrushes are migratory birds, leaving the cold regions in the winter for warmer climates.

## THE BALTIMORE ORIOLE

THE Baltimore Oriole is a true American, for he is found only in the New World. In the summer he goes as far north as Lower Canada and Manitoba, and in winter he flies southward, even as far as Brazil. He never welcomes the opening spring, however. Even in warm Florida he is seldom seen until March, and May is far advanced before he appears for his brief sojourn in New England. The male is usually the first to arrive, and he sits in a tree for hours and calls in plaintive notes, which indicate unmistakably that he feels his loneliness. In a few days, however, the female arrives. Then melancholy is a thing of the past and the birds hold a gay carnival. Their happiness is often marred by bitter rivalries, for the Oriole has a fiery temper.

Golden Robin and Fire Bird are names sometimes given to him because of his brilliant plumage of orange and black. He is also called the "Hang-nest," because he suspends his nest from the branch of a tree. The Baltimore Oriole was so named long ago, because his colors of black and orange were those of the arms belonging to Lord Baltimore, to whom Maryland belonged in early colonial times.

While naturally a shy bird, he is so confident of the security of his nest, that he often builds it on a tree in the dooryard or in a city street. It is never found near the trunk of a tree, but is always dangling from the end of a long slender limb, far from the reach of the sly cat or other enemy. The nest is made with great skill. It is shaped like a slender bag, is five or six inches deep and has its opening at the top. The Oriole first fastens stout thread of plant fiber or ordinary strings, if he can find them, around two or three twigs at the end of the limb. Weaving downward, he makes a strong fabric like coarse cloth of grass, ravelings of cloth, silk threads and similar materials, and the whole is carefully sewed together with hair from the manes and tails of horses. So skillfully is this work done that the bag is very strong, and will hold considerable weight.

The real nest, which is placed in the bottom of the bag, is made of wool, hair, lint and the soft, thin bark of grapevines. In this the eggs find a warm resting place. Both male and female work busily at the task of building the nest, but the female does most of the weaving and sewing, while her mate finds and brings the materials. She occasionally rejects fibers or hairs which he may bring, and sends him off for others better to her taste. Suspended in the air, the nest swings to and fro in the breezes and makes an ideal cradle for the little Orioles.

"Rock-a-bye Baby, in the tree-top;  
When the wind blows, the cradle will rock."

Should you see a pair of Baltimore Orioles in your shade trees early in the season, hang some wool, hair or similar material about the branches. They will quickly use it for the construction of their nest and will probably build it in the immediate vicinity. It saves the male much labor in flying to and fro in search of proper materials. Your reward will be ample in the pleasure of watching these beautiful birds as they fashion their nest, fly about among the trees and sing in full, mellow tones.

This Oriole is a gay and lively fellow. Ever active and sprightly, he darts in and out among the branches, and when his black and orange coat is placed against a background of apple blossoms, he makes one



of nature's brightest pictures. From his throat is ever pouring a lively melody of song, and often it is such a hurried ditty that the notes can scarcely be distinguished. Sometimes it suggests the merry whistle of the mocking-bird and sometimes the babbling of the thrush.

Caterpillars are in high favor with the Oriole when he is hungry, and he selects them as the best food for the young birds in the nest. When in search of caterpillars, he swallows as many as he can and, on his return to the nest, he disgorges them to satisfy the appetite of the young birds. The Oriole's table manners are certainly bad, but he is brought up in this way, so he never learns a better one. He also eats beetles, plant lice and other insects which he catches on leaves or in the grass. Unlike the whip-poor-will or the cedar bird, he seldom seizes them while they are on the wing. Ripe fruits and berries sometimes vary his diet, but the injury he does to the farmer is very slight.

The Orchard Oriole is a trifle smaller than his Baltimore relative and is not so brilliantly colored. Chestnut takes the place of the showy orange that distinguishes the larger bird. His nest is woven similarly to that of the Baltimore Oriole, but is not so deep. This bird does not range as far north as the Baltimore Oriole, but otherwise there is little difference in their habits.

The eggs of the Baltimore Oriole are dull white, scribbled over with brown and black. Those of the Orchard Oriole are a trifle smaller, but marked in a somewhat similar manner.

## THE WRENS

THE Wren family is quite large and, while the various branches differ in many respects, all are alike in their great activity and industry. You are doubtless most familiar with the House Wren, for he delights to make his home near the dwellings of men. During the nesting season, he is always cheerful and is a constant singer of trilling songs of much sweetness and considerable length. There is, however, another side to his character with which few are familiar. Toward the end of the summer season, when all the young have been sent forth, he lays aside that familiarity which endeared him to us, and withdraws to some lonely spot. There, songless and secluded, he lurks about the bushes till it is time for him to depart for the South.

He usually arrives in the middle states during April, but does not reach New England till the first of May. With his mate, he at once





FROM COL. F. M. WOODRUFF.

BALTIMORE ORIOLE  
 $\frac{2}{3}$  Life-size.

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FROM COL. F. M. WOODRUFF.

HOUSE WREN.  
Life-size.

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sets out house-hunting. First of all, they visit the quarters they occupied the year before, with the hope of moving in at once, for in that little nest was condensed a whole summer's happiness, with its sunshine, music, babies and housekeeping. It may have been their abode for several summers and they regard it as too precious to surrender to other birds without a struggle.

Although small, the Wrens are very courageous when defending their nest or their young, and do not hesitate to attack birds twice as large as themselves.

If another nest must be built, any convenient cranny is deemed a suitable place for it. The thatch of a roof, a corner under the eaves, even an old hat in the crotch of a tree, or an empty tomato can nailed to a post, will answer the purpose. What the Wrens especially seek is good shelter from wind and rain. With a satisfactory nook at their disposal, they fill it with twigs and grass, and outside they construct a sort of barricade of strong sticks. They leave a hole barely large enough for an entrance, and, as nearly all their enemies are larger birds, they feel quite safe behind their fortification. However rough the outside may appear, there is always a snug little place within, with a finely woven lining of grass, feathers and horse-hair. Here are laid six or eight tiny eggs, about half an inch long. They have a pinkish tinge, with light brown spots. The House Wren's coat is a reddish brown, with lighter lines on the wings and tail, and his breast is a dull white.

It is the Wren's nature to be always busy at something, and so he sometimes builds another nest, though he may have no use for it. All Wrens are fond of their young and provide an abundance of food for the hungry little mouths. When old enough, the little birds are given an occasional outing by their careful parents, who instruct them in the art of flying and in the business of catching insects. They doubtless give solemn warning also as to the cat, who regards a Wren as a delicious morsel.

The tiny Winter Wren is a hardy bird and has been known to remain in the middle states during the coldest months. Next to the humming-bird, he is the smallest bird we have. Like the House Wren, he often builds his nest near the house or barn, though it is more likely to be found in the thickets along the banks of streams, where a rotting log or a crevice in a stump serves him for a nesting place.

The Long-billed Wren is larger than the House Wren, though his coat is much the same in color, except for streaks of white on the head and back. The eggs are often so thickly dotted with brown that they seem to be almost entirely of that color. The Marsh Wren



shuns the dwellings of men, and makes his home in marshes and along the banks of rivers and ponds, where there is abundant growth of reeds and plants. He makes a nest of rushes, woven together so as to form an oval-shaped ball. This he fastens to the reeds where it will swing safely above high water. In the side is an entrance, and within it is made soft and comfortable by a lining of grass and feathers. Like other Wrens, this bird often builds more than one nest, apparently for no other reason than to have something to do. The insects that frequent marshes and ponds are his favorite food, and in searching for them he flits here and there among the reeds, or plunges his long bill into the water, to seize one he sees floating there. His song is a lively warble, though not so musical as that of the House Wren.

The Short-billed Marsh Wren is smaller than his long-billed relative, though he has the same coat of brown, streaked with white or buff. The eggs of this species are white and the nest in which they are laid, instead of being suspended from reeds or cat-tails, is placed on the ground in a tuft of grass. Grass is woven together to form a sort of ball, with an entrance at one side. Within it is lined with the soft down of plants. This bird has a lively, trilling song, which changes to a tone of alarm and anger if a stranger approaches the nest. He feeds upon the water-beetles and moths abounding in his neighborhood.

The Carolina Wren is a bird of the South and is seldom seen north of Jersey. He is as spirited, as courageous and as industrious as his northern brethren of the Wren family. His coat, also, is similar to theirs, but he is larger than any of them. His nest is usually placed in a hollow tree or a thicket. Grass and leaves are used to make the nest, which is lined with plant-down and feathers. He has a smaller family to look after than does the House Wren, for ordinarily there are but four or five eggs in the brood. These are white, tinted with buff or pink, and spotted with brown at the larger end. In his song he imitates the notes of the oriole, the bluebird, the cardinal bird and many others. For this reason he is sometimes called the Mocking Wren.

All the members of the Wren family are model birds. They are always industrious and thrifty, and, as their diet consists of insects, they levy no tax on the farmer's crops. With all their good traits and cheerful music, they cannot fail to win our friendship and admiration.

## THE VIREOS

THE Vireos are an American family of small singing-birds, as tune-ful as the warblers and as active as the wrens. There are forty or fifty species, but only a few of them are common in our own country.

The Red-eyed Vireo is found throughout the eastern United States, but only in summer, for as the sun declines to the south, he seeks refuge in Mexico and Central America. His coat is olive green, so much like the foliage of the trees in which he spends much of his time, that he is not readily noticed except when he moves, or when we catch a glimpse of his brilliant, ruby eye. He is a tireless singer, and even at noonday, in the hot summer, when most of the birds are quiet, the Vireo continues to sing as gayly as ever. His song is a constant warble, with varying expressions that seem to be delivered with the earnestness of an orator asking questions. It was because of this peculiarity that Wilson Flagg, the famous bird-lover, called this bird "The Preacher." He is an active bird, continually hopping about in pursuit of flies and caterpillars, and does not interrupt his song even when in search of food. The Vireo is an expert fly-catcher. In the fall he eats berries as well as insects, but does not trouble the grain. The Vireo builds his nest in shade trees on the lawn, in the orchard, or near the edge of a wood. It is suspended from forked twigs and made of strips of thin bark, grass and fibers. The paper-like substance of the wasp's nest or the web of spiders and caterpillars is sometimes added, and the inside is neatly lined with some soft material. The four or five white eggs are spotted with brown at the larger end.

The Warbling Vireo has a coat like that of the Red-eyed, but his eye is a dull brown, instead of ruby. His song lacks the questioning note of the Red-eyed Vireo, and he is a more continuous warbler. He chooses a lofty tree like the elm, in which to build his nest.

The White-eyed Vireo, unlike his cousin, builds his nest in a low bush, often in a swampy thicket. He lingers near the water, where he finds an abundance of the insects on which he feeds. He has an olive-green coat, but on the sides is a touch of yellow, and a yellow line appears around his white eye.

The Yellow-throated Vireo has a bright olive coat, with rich yellow on his throat and breast. The dusky wings and tail are edged with white. He builds a nest in the woods, and covers it with moss and lichens, so that it resembles the color of the branches.



The songs of the Vireo differ more or less in the different species, but all have a pleasing, warbling note. Their nests are of the same general pattern, and they are all insect and berry eaters. The name "Vireo" comes from a word which means "green." The Red-eyed Vireo is one of the birds most often imposed upon by the cowbird, who leaves her eggs for the Vireo to hatch, and the young cowbird receives unselfish care from the gentle bird in whose nest he has no right.

### THE CANARY

THE dainty Canary is one of the most popular of household pets. He is perfectly content in his cage, and never pines for the freedom of his ancestral forests. Even if he escapes from his captivity, he usually returns to the sheltering roof, as if convinced that there is no place like home.

The Canary was first found in the Canary Islands, though he is also a native of the Azores and the Madeira Islands, in Atlantic waters. He received his name from the mountainous islands in which he was first discovered, and which are embraced by the torrid zone. The haunts of the Wild Canary are in some of the highest altitudes, and this possibly accounts for his ability to live in the colder countries of the temperate zone.

In its wild state the Canary builds a dainty nest of soft materials, in the top of a lofty tree, and carefully lines it with feathers or hair. In this are laid five small blue eggs, and, in the course of a year, several broods are hatched. Insects and the seeds of various plants are the Canary's natural food, but in captivity he adapts himself to the methods of civilization, and learns to like, besides his staple diet of seeds, the crumbs of bread and crackers, potato and egg, and an occasional taste of apple or sugar.

Canaries were first brought to Europe in the sixteenth century, and were bred in Italy. From there they were sent to England, Germany and other countries, and became very popular. They are occasionally bred with other birds, like the linnet and the finch, and thus are produced a variety of colors in their plumage. At home, in the Canary Islands, this little bird has a brown coat, but like other birds and animals, their coats grow lighter in color as they accustom themselves to live farther north. In England the Canary is larger than our little yellow songster, sometimes called our Wild Canary, and has reddish-yellow plumage, which becomes in some cases a deep red, so that the name, "Red Canary," is given



CANARIES.  
Life-size

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FROM COL. CHI. ACAD. SCIENCES.

ENGLISH SPARROW.  
Life-size.

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to him. Canaries from Germany have a mottled coat of greenish brown, while others from the same place are yellow.

These birds are often spoken of as "Hartz Mountain Canaries." This is because the German peasants dwelling in the Hartz Mountains, in Germany, raise Canaries in great numbers. Many of these poor people make their living solely in this way and their houses are filled with bird cages. These birds are usually fine singers and are popular pets.

While many Canaries are annually imported into this country, a large supply comes from Milwaukee, where they are raised for the market in great numbers. No pains are spared in producing good singers and the young birds are trained to sing by means of a bird-organ, which imitates exactly the Canary's notes.

The song of the Canary is a high treble, sometimes very sweet, and again so shrill as to be almost piercing to the ear. Among his notes he occasionally introduces a warble or yodel, but it is said that only the Canaries bred in the Hartz Mountains have this gift perfectly developed, and that they lose it after living a year or two in this country.

If well cared for, Canaries live to be several years old. Like other pets, they need clean surroundings. With these and with an abundant supply of suitable food, they rarely sicken, and they will sing in their cages as bravely and sweetly as if they were free to roam the air.

To bird lovers, pet Canaries are a never-ending source of pleasure, and many an otherwise lonely house is made joyous by the presence of these cheerful little creatures. Their dainty habits are very interesting to watch. The bright little things at their morning bath are an especially pretty sight. They dip their delicate forms into the water, spraying it into the air with their wings, and appear to enjoy the proceeding to the utmost.

## THE SPARROWS

THE Sparrows, Finches, Grosbeaks, Redbirds and Buntings all belong to one family, which is the largest in the Bird Kingdom.

Sparrows abound all over the world, except in Australia, and were common as far back as the days when the old Hebrew prophets wrote. In the New Testament, too, you will remember that Christ mentions this bird, for he says:—

"Are not two sparrows sold for a farthing? And one of them shall not fall to the ground without your Father. Fear not, therefore; ye are of more value than many sparrows."



Christ probably used the Sparrow to illustrate his sermon, because it was one of the commonest birds in Palestine, as it is to-day. Sparrows nest in great numbers on the ground and in the bushes along the banks of the River Jordan, and in the city of Jerusalem they are considered a great nuisance, as is the English Sparrow in America.

The English Sparrow is the most arrogant little bird that ever waged war against his fellows. He acts as if he owned every cubic inch of air, and every tree in the world. He has invaded our cities in such numbers that other and more popular birds have been compelled to seek other homes.

The English Sparrow was brought to our country not many years ago, for the purpose of killing off the canker-worms. While most species of Sparrows feed on seeds, the English Sparrow was known as a good insect-killer. In 1851 the shade trees in Brooklyn, New York, were visited with a plague of canker-worms which threatened their destruction, and Hon. Nicholas Pike, who believed he was doing a good thing for the trees, brought over from England a number of these Sparrows. The first lot did not thrive in their adopted country and in the three years following more were brought over. Some were set free in New York, some in Quebec, some in Portland, Maine, and some in Boston. In 1869 Philadelphia received a large number from England. Thirty years ago the English Sparrow was known only in a few large cities on the Atlantic Coast, but now he has overrun the whole country. He may have helped to exterminate the canker-worms, but he at once began to wage war upon our beautiful song-birds, and expelled them from the cities. Immigrants are supposed to have some little respect for usages in the land of their adoption, but in this case the immigrant proceeded to carry things with a high hand.

A price has been set on his head, and this has led to the killing of thousands upon thousands. Yet they thrive and multiply, despite every measure taken for their suppression. This bodes ill for the robins, the bluebirds, the grosbeaks, and other native favorites, which are gradually disappearing before the invader.

It is not only in his relation to other birds that the English Sparrow proves himself obnoxious; he is also a domestic tyrant and can hardly live with himself. When no other bird is near to furnish him a pretext for a disturbance, he quarrels with his own family. The female is more peaceably disposed than the male, and he tyrannizes over her in a shameful manner. He is fickle as well as captious, and sometimes expels her from his house, and, without awaiting any formalities, gets a new mate who happens to strike his fancy.

He has developed a taste for vegetables, grains, grass seed, buds of trees and plants and other things, which we would prefer to have left alone. In fact he understands the art of making himself unpleasantly familiar, wherever he may be.

He has become so thoroughly acclimated to all parts of the country that he does not find it necessary to leave the North for the winter. From Boston to New Orleans, he is at home at all seasons of the year. His favorite motto seems to be "Fight whenever you can find anything to fight over, and when you can't, invent some pretext to fight." Such a motto, of course, could not fail to make a disagreeable bird.

He builds his nest in any nook or crevice that offers a space of three or four inches and, when practicable, seems to select a place where his nest will give the most trouble. He delights to establish himself in the gutter-spout or under the eaves. When snow comes, and the water backs up and freezes, and the pipes burst, and the roofs leak, people looking for the cause of the trouble may find that an English Sparrow has blocked up the outlet with his nest. He likes to nest in the carved stone crevices of our public buildings and even on statues in the public parks. No place is sacred to him, and he has disfigured some of our finest buildings.

His nest is made of grass, fibers, threads, strings, rags or anything that is easily woven into a fabric, and the inside is lined with feathers or hair. He works hard to put it in order, that he may devote his time to making trouble for others, which is his favorite diversion. Providing a home and food for his family are merely incidental. The female lays from four to seven small eggs, which are grayish white, striped with brown and lilac. The English Sparrow makes no pretension to vocal culture, but perhaps his constant scolding makes his throat hoarse.

His defenders contend that his destruction of insects entitles him to our respect. But before his advent in this country, the song-birds ate them. He has driven away the songsters, and remains to brag and seold in the places that once rang with sweet music.

We have our own American Sparrows, which are very bright and happy little birds. Our Song Sparrow passes the winter in warm climates, but early in the spring he ranges north and builds his nest in a field or pasture, sometimes in the grass or under a low bush, and sometimes in the cavity of a tree. When he is startled from the nest, he flies away with a quick, jerky motion of his tail, uttering a sharp "Chink! Chink!" His back is streaked with black, dark chestnut and ash; his wings are brown, edged with dull red; underneath he is white, and his breast and throat are spotted with brown. His cheerful song blends with the symphony of the early spring.



The Swamp Sparrow's habits are suggested by his name. He is usually found in swamps and marshy meadows, where he darts from hummock to hummock, in his search for insects. He runs swiftly over the ground, and his black and brown coat so nearly resembles the color of the earth, that when he disappears under a tuft of grass, it is hard to tell where he has gone. When he is seeking food, he keeps very quiet. It is in the early morning that he warbles out his song. From so much running through the bushes and over rough ground, his coat often becomes frayed and ragged, and his tail is sometimes worn to a stump.

The Field Sparrow prefers the uplands, a pasture or, perhaps, a hillside, or open woodland. He is a shy bird, but when he thinks himself unnoticed, he sings a trilling song like that of the canary. His coat is reddish, with buff and black stripes, and his crown is chestnut. His breast is white, and there are two bars of white across his wings.

The Fox Sparrow is one of the largest and handsomest birds of the family. His coat is foxy red, with ash-colored streaks, and his white breast is spotted with dark red. His song is loud and joyous.

The Chipping Sparrow is one of our friendliest little birds. He has a chestnut cap and a black forehead. His pretty little nest, neatly woven of grass and roots and lined with horsehair, is often found in the bushes under a window or in an orchard tree, and he comes bravely to get the crumbs we leave for him on the door-step or window-sill. The English Sparrow often drives him away and takes the crumbs for himself, for the "Chippy" is a timid little fellow, and is not large nor strong enough to hold his own with other birds. His song is a simple trill or chipping.

All the Sparrows eat seeds and insects, and none of them, except the English bird, is troublesome. On the contrary, they are delightful little neighbors, and their piping notes and cheerful songs are always pleasant to the ear. They are so small that we cannot help feeling a desire to protect them, and when they linger at the approach of winter, they are, no doubt, grateful for a chance dinner of bread-crumbs, which may induce them to visit us again when the warm weather returns. The bold English Sparrow seems able to take care of himself at all times, but when all the other birds are gone, and we see him shivering in the snow, he also is apt to win our sympathy to the extent of a scattering of seeds and crumbs. Alas! such generosity usually leads to a quarrel among all the English Sparrows in the neighborhood.

## THE SKYLARK

THE Skylark does not command admiration by brilliant plumage, but he has endeared himself to the human race by his glorious song. He has been the theme and inspiration of many beautiful poems. At the first hint of dawn, you may hear his clarion notes, as he soars higher and higher, until he appears like a speck against the blue sky and his song is almost lost in the distance. Yet, sweet and faint cadences continue to reach us, and when he begins to descend, the rich waves of melody increase in volume as he nears the earth.

In Europe Larks abound in the fields and meadows, where they build their nests and search for the seeds and grain on which they feed. It is while the mother bird is sitting on her nest that her mate soars into the air and pours forth his rich melody. Several attempts have been made to introduce the Skylark into America, but our climate is not suited to his needs and temperament.

In America the Horned Lark is the best-known species of the family. There are many varieties of this species, and they differ in plumage and habits, according to their location. Such names as Snow Lark, Prairie Lark, Shore Lark and American Skylark are given these varieties. The color of the Horned Lark is a grayish brown, in which appear streaks of darker brown; he has a black patch across the forehead and along the side of the head, and another of black under the eyes; over the eyes is a line of yellow. The throat is of the same color, with a patch of black. Behind the ears are little tufts of black feathers which give his head the "horned" appearance from which he receives his name.

The Horned Lark is a hardy bird, and from October to April is found in the northern states and in the south as far as Georgia. He is often seen when there is snow on the ground and from this fact is sometimes erroneously called "Snow-bird." In summer he flies northward as far as the Arctic Circle.

The nest of this bird, which is always found on the ground, rests on a bed of moss or grass, and is lined with feathers or other soft material. The mother bird lays four or five eggs, of dull white, tinted with purple or buff, and spotted with brown or lavender. The Lark searches for seeds and grubs, and in the fields and meadows does not hop about like the robin, but walks or runs swiftly. He soars high above the earth, like the English Skylark, but his song is much simpler and less musical. When he descends, he never alights on a tree, but usually on a fence-rail, a building or the ground,



from which he can plainly observe his surroundings. Horned Larks are often seen in companies on the shores of bays and streams, where they search for food, and, while running about on the ground, they send out sentinels to notify them of any approaching danger.

The Meadow Lark, or Field Lark, is also common in the United States. He is larger than the Horned Lark, but less hardy, for in the winter he does not remain in the North later than November. He prefers the sunny South until the warm days of April return. His coat is a grayish brown, streaked with black. His breast, generally, and the spot over each eye are bright yellow. On his breast is a crescent of black, but he lacks the little tufts of feathers which give the Horned Lark his name. The five white eggs, spotted with brown and lavender, are laid in a nest of dry grass, sometimes placed in a hollow in the ground and at other times sheltered by a tuft of grass. The nest is sometimes covered at the top, so that the bird enters at the side. It is usually found in a level meadow.

The Meadow Lark eats grasshoppers, worms, spiders, caterpillars and the seeds of grasses, but does not trouble the grain, and is therefore one of the farmer's best friends. His note is a mellow whistle, which usually lacks the elements of melody, but, nevertheless, falls pleasantly on the ear. He flies slowly and heavily, and, unlike the Skylark, does not soar high or long in the air.

### THE NIGHTINGALE

THE Nightingale, so often mentioned in prose and poetry, is a bird of the Old World and is not found in the United States. His name comes from an Anglo-Saxon word which means "Singer of the Night." The bird does sing at night, and during the day as well, and his song is very sweet. The British people think there is no bird in all the world to compare with it, but, as a matter of fact, our mocking bird is a better singer; and, indeed, where is the bird across the sea that can equal him for sweetness of tone, power and long-continued song?

But the Nightingale stands at the head of the singing birds of the Old World. He is found in many parts of Europe, Asia and Africa, and is supposed to have been the bulbul described by the Eastern poets of long ago. He is a migratory bird and spends the winter season in the warm countries under the equator. In size he is a trifle longer than a sparrow and wears a modest coat of brown, with a tinge of red on the back and tail and a suggestion of white on the throat and lower parts.

The Nightingale makes his nest in a hedge or thicket, where he can be sure of seclusion. The nest is made of leaves, grass and roots, and rests on or very near the ground. Four or five olive-brown eggs are laid, and the parent birds take turns in sitting on the nest.

This bird belongs to the family of Warblers. His song is sometimes heard during the day, but is usually at its best in quiet, moonlight evenings. There is a plaintive theme in his song, and the poets have fancied that he is appealing to a lover or sweetheart; in Eastern poetry he is often represented as being the lover of the rose, and it is to her that he is supposed to sing his passionate song. Pleasing as the song is, it is really no more stirring than that of the skylark.

The Nightingale begins to sing at the opening of the mating season, late in April, and continues his singing until the young birds appear and demand all his attention. He is always very shy, and while you may hear him singing near by, you may not find his nest or even catch sight of him for many days, for at the least alarm he darts into hiding and his coat is so like the vines and bushes in color that he is not readily discovered.

If full-grown Nightingales are placed in captivity, they soon pine and die, but if the young birds are taken, just as they are about to leave the nest, they may be raised successfully in a cage, and in England this is often done.

## THE RED-WINGED BLACKBIRD AND THE GRACKLE

THE Red-wing is a merry fellow, though too saucy in his bearing and too fond of good ripe fruit to please the farmer and the gardener. His life is active and his instincts are social, especially in the latter part of the summer season, when he moves in large flocks.

The Red-winged Blackbird is the common species throughout North America, and has a conspicuous black coat, and red feathers tipped with buff on the upper part of his wings. The vivid dash of red against the black forms a striking contrast as he flies through the air. He spends the winter in the South, but from March to October he sojourns in the northern states. While mating, he leads a quiet and domestic life, and keeps to the marshes and meadows, where he builds his nest in a tuft of grass or under a bush. The nest is woven of flags or long grass and lined with finer grass. The eggs, which vary in number from three to five, are white or of pale bluish-green tint, and are marked with lines of black and purple.



In July or August, after the young birds have gone out to make their own way in the world, old and young enter upon a social career. They assemble in flocks, descend on fields of grain and often do serious damage. They make some amends by destroying insects and grubs, which are injurious to the farmer, but as he sees less of the good than of the evil they do, he is inclined to regard them with disfavor. The rice fields are a rendezvous for the blackbirds in their southern haunts. There they are frequently seen chasing each other on the wing as if in play, and all chatter at once. Their cheerful, liquid note sounds like "Con-quer-re! Con-quer-re! Bob-a-ly-bob-a-lee!" and when a flock of Red-wings gives a general concert, it may be heard for a considerable distance.

The Crow Blackbird, whose real name is Purple Grackle, has a coat of bronze black, and is common in all parts of the United States east of the Rockies. His nest is built on the bough of a tree or in a cavity like that made by the woodpecker. Sometimes nests of both kinds are found in the same tree. The Grackles begin their attack on the cornfield as soon as the seeds sprout, and sometimes the ground is black with them as they pull up the tender blades. Later, when the corn is forming ears, they feast on the milk. The farmer, who sees his corn destroyed, but does not think of the grubs and worms the Blackbirds have eaten, makes war on the birds without mercy. In the winter they eat beechnuts and acorns. The Grackle is a good fisherman, and catches minnows and young fry in the brooks. Like the crow, he sometimes kills and eats the young of other birds. He likes to impose on other birds but resents any interference with himself, and thus he spends no little time quarreling with the robins, catbirds and jays.

## THE WOODPECKERS

THE Woodpeckers are birds of steady habits, and most of them are very industrious in carpentry. Their only cutting tools are their sharp bills, yet they readily bore the most symmetrical of holes in the hardest trees. It is from this tree-boring habit that they derive this name. The greater part of their life is spent in clinging to the trunks of trees, while they dig out the insects with their bills or make cavities for nesting.

The Woodpeckers belong to a numerous family of about two hundred and fifty species, and they are found in all wooded parts of the world, except Australia and the Island of Madagascar. In North America are found about thirty species, which differ from each other in size and in the color of their plumage, but are very much alike in





RED-WINGED BLACK BIRD.

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FLICKER.  
¾ Life-size.

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their habits. The Little Downy Woodpecker will answer well to illustrate this family.

This Woodpecker makes his nest in the trunk of a dead or dying tree. To do this he bores a hole, an inch and a half in diameter, for an entrance. When he reaches the soft center of the trunk, he turns downward, and enlarges the cavity, which he drills to a depth of nearly a foot. In this cavity, safe from wind and rain, he takes up his residence and the female lays from three to five eggs, which, as in all of the family, are glossy white. Sometimes the Woodpecker uses the same nest for two years or more in succession. Other birds and squirrels often take it for their own use, to save the labor of making one for themselves. The black snake is also an unwelcome intruder. When he finds out the Woodpecker's hole, he enters and eats the eggs or the young birds, and then for a brief time takes the nest for his own, to the great distress of the bird which worked so hard to make a home. You may imagine the feelings of a boy who has unwisely decided to take the eggs or the young birds from a Woodpecker's nest and who forces his way into the deep hole, only to grasp the coils of a snake!

Nature has especially adapted the Woodpecker for climbing and boring. He has four toes, two of which extend forward and two backward, and they are armed with sharp claws. This enables him to get a firm hold on the bark of a tree. To help support him, he has, also, long, stiff, pointed tail feathers, which rest against the tree and prop him from beneath. In this attitude, with his breast close to the tree, he moves his head back and forth very rapidly, and at each motion his sharp bill drills into the bark and wood. He makes a hole of considerable size in a short time. The noise he makes is like the rapid tapping of a hammer, or, if it is a hollow tree, like the roll of a drum. The bird seems to enjoy this noise, for he sometimes hammers on a tin gutter or some hollow pipe.

The Woodpecker's habits are useful to man, for he pecks out the insects and grubs that destroy trees. If it were not for his work, some of our forests would be destroyed by the insects which penetrate the bark and sap the life of the trees. Besides the tree-bugs which he gets in this way, the Woodpecker eats caterpillars, beetles and ants. Other birds could not get at the insects after they have penetrated the bark, but the Woodpecker readily destroys them. Not only is his bill long and sharp, but his tongue is horny at the end and provided with little barbs, like those on fishhooks. He drives his tongue into the body of an ant or other insect and the barbs hold it fast. His tongue is also coated with a substance like glue, so sticky that any insect that touches it is held fast.



The Downy Woodpecker is the smallest of the family in America, being little over six inches long.

The Golden-winged Woodpecker—which is sometimes called the “Yellow Hammer,” and, by naturalists, the “Flicker”—is one of the most beautiful of our birds. His back is brown, barred with black; his head and the sides of his neck are blue or gray and on his nape is a dash of red. Running back from his bill, on either side, is a stripe of black. The breast has a crescent of black and the feathers underneath are pale brown, with yellow shadings, and on each breast feather is a round dot of black. The under surface of the wings and the tail is golden yellow.

This bird is found as far north as Alaska, but migrates to the South in winter. He is less fond of hard work at the carpenter's trade than other Woodpeckers are, and selects for his operations a much-decayed stump or log, which is more easily bored than a living tree would be. Here, too, he usually finds many ants, of which he is very fond. They constitute a large portion of his food, and to get them he often raids their “hills,” or watches for them at the entrance to their holes in the ground. Sometimes the Flicker bores through the boarding of a barn or a dwelling and makes his nest between the cross beams, or he will bore into a telegraph pole, if his fancy turn that way.

The Red-headed Woodpecker is one of our common birds and is found in many parts of the United States. When winter approaches, those in the North join their relatives in the South, to avoid the cold. They are said to migrate only in the night, stopping during the day to rest and feed. This bird's back and tail are a purple black; the head and neck are crimson and the breast and the tips of the wings are white. Where you find a forest with many girdled and dead trees, you will find many nests of the Red-headed Woodpecker. He not only digs insects from the trees, for food, but has a pronounced taste for fruit and visits the orchards where cherries, apples and pears are to be found. He thrusts his sharp bill beneath the skin and sucks the juices of the fruit, or carries off on his bill an apple or pear. He also helps himself to the milk of young sweet-corn, of which he is very fond.

The California Woodpecker is much like his Red-headed relative, though he has less white and less red in his coat. He is seen only west of the Rockies, where his home is usually to be found in the pine forests on the mountains. He is a sociable fellow, and sometimes half a dozen Woodpeckers make their nests in a single tree. He likes insects and fruits, and acorns are one of his principal items of food. He lays up a store of acorns in holes which he has drilled in

the trunk of a pine or oak tree, or in a fence post. Each hole is so nicely drilled that the acorn, which is driven in point first, fits in its place snugly and is not easily removed. Sometimes two or three hundred acorns will be found stored in a single log or tree trunk.

When the Woodpecker wishes to eat one of his acorns, he takes it from the hole and drives it into a crevice in some tree. This splits it open and enables him to discard the shell and get at the meat. This practice is not confined to the California Woodpecker, but is shared by other members of the family. It was thought at one time that the Woodpecker saved the acorns for the sake of the worms which developed in them, but we know now that he eats the sound nuts as well as the wormy ones. If he happens to find a fat, juicy worm in one of his acorns, it adds to the relish of his dinner. Other birds and squirrels sometimes try to steal his acorns, and if he discovers them in the act, there is a quarrel immediately. The squirrel he soon puts to flight, but if the robber is a blue jay, there is likely to be a sharp battle. The California Woodpecker usually builds his nest in an oak or sycamore tree, from twenty to twenty-five feet above the ground.

The Hairy Woodpecker is much like the Downy already described, but larger. His feathers are black and white, and he has a red band at the back of his head; in the female this band is wanting.

The Arctic Three-toed Woodpecker differs from most other species in having three toes instead of four, but he seems to be as good a climber as his four-toed cousin. His feathers are black and white, and he has a spot of yellow on his head. He is found only in the cold regions of the North, and comes no farther south than the northern tier of states. Closely related to him is the American Three-toed Woodpecker, also a bird of the far North.

The Ivory-billed Woodpecker, on the other hand, is found only in the southern Gulf states. He is the largest of the North American Woodpeckers, measuring twenty inches or more in length. His feathers are mostly black, though he has a stripe of white on the side of the neck and some white on the wings. The male bird has a crest of scarlet and black. This bird has a long bill of the color of ivory. He is shy and is rarely seen in settled regions. The dense cypress swamp is his favorite haunt. He digs his nest at least forty feet from the ground, in the loftiest tree he can find. This bird eats little besides insects, and does not trouble the farmer's corn or fruit trees, although he likes berries and grapes.

The Woodpeckers do not sing, but each has his peculiar call, consisting of a few notes repeated swiftly. They are most easily recognized by the drumming noise they make when tapping wood.



## THE CUCKOO

TO MANY of us, the name "Cuckoo" first suggests a clock—one of those little clocks high up on the wall, with weights swinging on long chains underneath, and a little wooden bird that pops from a tiny door and announces the time by calling "Cuck-oo, cuck-oo," the number of times of the hour. If we have known no more than this of the Cuckoo, we have at least had an accurate reproduction of the live bird's call.

The Cuckoo has been represented as being very undomestic. It is true that in Europe the female does leave her egg in the nest of some bird, which she knows will submit to the imposition. The young Cuckoo is hatched by his foster-mother, who feeds him as faithfully as she does her own; while his own mother never seems to crave the tender cares and joys of bringing up a family, but prefers to wander in careless freedom, like a gipsy of the air.

The American Cuckoos, however, have more of the home instinct, and build nests of their own, though they, too, have their faults, for they rob smaller birds of their eggs. It is the European bird, however, that makes the name a synonym of shiftlessness in the home.

There are six species of the American Cuckoo, only two of which may be called common birds—the Yellow-billed and the Black-billed Cuckoos.

The Yellow-billed Cuckoo spends the winter in the South and comes northward in the spring. He is about twelve inches long, though his tail feathers reach nearly half of this distance. His plumage is olive gray, the wings tipped with dull red; the middle tail feathers are of the same color as his back, and the outer ones are black with white tips. Underneath he is white. The upper half of the bill is black, and the lower half yellow.

Among the Cuckoos, the mating season is rife with tiny feuds, the male birds often clashing with their companions in the choice of mates. The nest is built in a bush or on a limb of a low tree, in quiet woods, or in an apple-tree in the orchard. It is not a very handsome structure and is, in fact, little more than a rough platform of twigs and weeds loosely put together. The four eggs are of a pale greenish color. The Yellow-billed Cuckoo has one habit in which it differs from most birds. The female lays her eggs at long intervals, so that the young are hatched one at a time. Other birds usually lay one egg each day until a brood is completed, and all the young birds come from the shell at about the same time.

The Cuckoo has no sustained melody, but his soft notes are very appealing, and his voice has both power and volume. Though he

repeats the same cry over and over, he is a sure harbinger of spring, and his voice is so welcome that we do not think of calling it monotonous.

The Cuckoo eats insects and berries, as well as the eggs of other birds. He does no little good in eating the hairy or "tent caterpillar," which other birds will not touch. As this is the caterpillar that makes the nests called "worms' nests" in the trees, the Cuckoo is of great value in destroying it.

The Black-billed Cuckoo resembles the Yellow-billed species, but has little or no rufous on his wings and his bill is wholly black instead of half yellow. He is more retiring than the Yellow-bill, and usually nests in a low bush in the woods. Otherwise his habits are similar to those of the Black-billed variety.

### THE COWBIRD

THOSE birds which show shiftlessness and indifference in the construction of their nests are not the bright and cheery songsters.

Such failings are deplorable, even in birds, and none have them to such a degree as the Cowbird.

It would be unjust to attach all the blame to the female, for it never occurs to her mate to provide a house and home for himself and his family. Yet the mother cannot be entirely freed from the charge of neglecting her babies. She has not a spark of maternal instinct. When ready to lay her eggs, she leaves the flock, and flies about the bushes until she finds the nest of some other bird. After depositing her egg in this, she returns to the flock, entirely indifferent to the fate of the little egg or her young. In a day or two she lays another egg in some other nest, and proceeds in this manner until she has laid perhaps four or five. She knows very well that if she left the eggs in the nests of birds larger than herself, they would be promptly thrown out. The angry catbird has been known to do this. The Cowbird watches for an opportunity to enter the nest of some small bird, when the owner is away, and, having laid her egg, flies away before the owner returns.

The Maryland yellow throat, which is one of the warblers, the yellow warbler, the red-eyed vireo and the chipping sparrow are usually the ones to find the strange eggs in their nests. If the Cowbird lays her egg before the foster-parent has deposited her own, the latter sometimes deserts the nest and builds a new one. The yellow warbler has a way of making another nest above the one that has been occupied. In some instances this is done twice, and



thus a nest of three stories is formed. Only the bluebird, who is greatly attached to her nesting-place, will accept the strange egg before she, herself, has laid, and go on with the work of rearing a family.

The Cowbird's egg hatches before the others, and the young intruder is so much larger than the little vireos or sparrows when they are hatched, that he often stifles them in the nest. Thus, this mother loses her own little ones as a result of caring for the orphan that was forced upon her. Nevertheless, she patiently feeds the greedy young Cowbird and tries to bring him up properly, as she would her own. As soon as he is old enough to look out for himself, he promptly deserts his foster-parents and flies off to join the nearest troop of Cowbirds.

These birds have so little regard for family ties that they do not even mate in pairs, but live together in flocks. They winter in the South, but by the first of April make their appearance at the North. They are often seen in the company of red-wings and crow blackbirds, to whom they are closely related.

The neck and head of the male Cowbird are covered with dark-brown plumage, and the rest of his coat is glossy black. The female has a grayish-brown coat. The Cowbird derives his name from the fact that he is so often seen near cattle, and in his search for parasites he frequently perches on the back of a cow. The Cowbird also scratches up the earth for worms and insects. He occasionally varies his diet with rice or corn, but, as a rule, he is content with insect food, and does not disturb crops as the blackbird does.

His shameless way of ignoring family relations makes it impossible for us to like or respect the Cowbird, and although he eats harmful insects, we cannot forgive him for his selfishness and unnatural conduct toward his young. The habits of the Cowbird are much like those of the European cuckoo, whose name is used in household proverbs as a synonym for shiftlessness. These birds are painfully like some people, who are too lazy to work and prefer to have other friends take care of them, rather than make any effort for themselves.

## FINCHES

THE American Goldfinch is also called the Yellow Bird and Wild Canary. He is a common bird in nearly all parts of the American Continent, and ranges from Mexico to Canada. He is a little fellow, only four or five inches long, but his bright plumage, seen as he darts swiftly from tree to tree, makes him seem like a





FROM COL. F. M. WOODRUFF.

AMERICAN GOLDFINCH.  
 $\frac{7}{8}$  Life-size.

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MARYLAND YELLOW-THROAT.  
4-5 Life-size.

FROM COL. F. NUSSBAUMER & SON.

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ray of sunshine. These birds are hardy and breed in the cooler climates. In the North they do not nest until May or June, and as they raise two broods each season, it is often late in September before they are through with their family cares. Even then they are in no hurry to seek warmer climates, and as long as their food supply is ample, they do not move to the South. Occasionally, one is seen after snow has fallen, seeking for seeds of grasses and weeds which have not been buried under the snow.

The male Goldfinch wears his dashing coat only in the summer. It is a bright yellow, except the crown, wings and tail, which are black. In the winter, his dress is less brilliant, like that of the female, who wears olive brown the year round, and has no black on her forehead.

The Goldfinches are sociable birds and live in companies. Other birds which dwell in flocks usually retire from the company when they select their mates, and build their nests in privacy, but the Goldfinches are found nesting near each other. A pasture or an orchard is a favorite place with them, and on the branch of a low tree, not more than ten or twelve feet above the ground, the Goldfinch builds a pretty, cup-shaped nest, so neatly made of bark, moss and fine grass that the outside is round and smooth. Plant-down and hair are used to make a soft lining. The five little eggs, each measuring a little over half an inch in length, are white, with a faint tint of blue, and marked with light brown dots.

Nearly all the smaller birds are insect-eaters, but the Goldfinch eats little except the seeds of plants. He does great good in consuming the seeds of troublesome weeds, like the thistle and the nettle. He seems to have a particular fondness for the seeds of the sunflower and if you have a few of these tall flowers growing in the garden, you are sure to see the Goldfinch visiting them when their seeds have ripened. He likes dandelion seeds just as well, and as he is not aware that he pleases us by eating some seeds and displeases us by taking others, he often helps himself to lettuce and flower seeds in the garden. His sharp little bill is like that of a canary, and he husks his seeds in the same way. It is interesting to watch him when he is busily engaged in shelling the seeds for his dinner.

Before the nesting season begins, the male Goldfinches assemble and sing as if in concert. Each seems to be trying to outdo his neighbors in the sweetness and strength of his song. The song is very sweet and beautiful, and has a certain musical perfection—a finish and delicacy, so to speak—that is lacking in ordinary bird songs. When the female is sitting on the nest, her mate remains near home, circling about in the air not far from the nest.



The European Goldfinch, which has been known for many years as one of the most famous of singing birds, is very common in Great Britain, and in recent years a few have been found in our country. He wears a coat altogether different from that of our Yellow Bird, the back being brown, the wings black, tipped with white and striped with yellow, the cheeks and lower throat crimson. In his habits, he is like the American Goldfinch.

The Purple Finch, or Linnet, is another member of the Finch family. Sometimes we call him the Strawberry Bird, for he eats strawberries, blackberries and the like, as well as buds and insects. His coat is not really purple, but a rosy crimson, which varies in depth on different parts of his plumage. It is a pale rose color on his breast, darker on his back and brightest on his head. The wings and tail are dark brown. Touches of gray appear over his coat. The female has no rose color, but brown and gray only. The Purple Finch is much like the Goldfinch in his habits and is often seen feeding with them. His song is like that of the Canary, but softer and sweeter.

The Pine Finch, or Pine Siskin, is less common than the other Finches. He builds his nest in a deep forest, usually on an evergreen tree. It is not as neatly made as that of the Yellow Bird. He is fond of the seeds of the hemlock tree and passes the greater part of his time in the pine woods.

The Lark Finch, or Lark Sparrow, is found only west of the Mississippi River. He is larger than other Finches and lacks their brilliant colors. His coat is olive and brown, with touches of black and white; a crown of chestnut, and a patch of black on his white breast. Like the Grass Finch, or Vesper Sparrow, he often builds his nest in a tuft of grass on the ground; at other times it is found in a tree or bush, as in the case of other Finches. The Lark Finch gets his name from the fact that he sings while on the wing. The Grass Finch is also a good singer. His habits are like those of the sparrows and with them he should really be classed.

The Shore Finch is also called Sharp-tailed Sparrow. He is usually found in a marsh near the sea or in a wet meadow, where he may be seen walking about on the floating weeds in search of insects.

## WARBLERS

THE Warblers are one of the largest families of our common birds. There are between thirty and forty species found in the United States, yet only a few of them are commonly recognized, except by those who have made a careful study of all the birds. Most of the Warblers are small birds—smaller than a canary. Some of them

spend nearly all their time in the trees and are rarely seen near the ground; others build their nests on or near the ground, and these become more familiar to us. The Warblers are migratory birds and visit the North only during the warm season. Some arrive in April, others in May, and they return to the South in September or October. Only one or two species remain through the winter as far north as New York.

The Black and White Warbler, also called the Black and White Creeper, is an odd little fellow, about five inches long. We seldom see him perching on the branches of trees, but he creeps or climbs around the trunk of a tree, pecking at the insects in the bark, for these constitute his food. His nest is built on the ground, at the base of a rock or a stump. It is made of grass, moss and the soft down of plants like the mullein. The mother bird lays four or five white eggs, flecked with reddish brown. During the nesting season, the male bird utters a succession of thin, piping notes, and later, as the summer advances, his song becomes mellower. It is never very loud or strong, yet it is pleasing to the ear. He has a plain coat of black, striped with white.

The Yellow Warbler, or Yellow Bird, has more dashing colors. His coat is golden yellow, tinged with olive on the upper parts, with orange-brown streaks on the sides and breast. The Yellow Warbler does not creep up and down the trees, but flies about in lively fashion, and catches insects on the wing. Most of the Warblers make their homes in the woods, but the Yellow Bird nests in parks and orchards and does not seem to fear man. He makes a pretty little nest of fine grass and pine leaves, and lines it with the softest plant-down and horsehair. Usually, the nest is placed in a shade tree or in the shrubbery about the lawn. The white eggs have a faint green or blue tinge and are marked with brown and purple spots. Besides insects, the Yellow Warbler eats a few berries. When strangers come near the nest, the mother bird tries to deceive them as to its location, by pretending to be lame and fluttering along on the ground just out of reach. When she is satisfied that they do not know where the nest is, or will not trouble it, she quickly flies back to her eggs or the young birds.

The Maryland Yellow-throat is a very different bird and ranges from Florida to Canada. He builds his nest on the ground or perhaps in a thicket of low bushes. Twigs and grass are woven loosely together to form the outer portion of the nest, and then a lining of soft materials is added. Swamp ground and damp woods are the most likely places in which to look for the nest of this bird. He is a lively bird and is constantly on the search for insects and bugs. He



does not often fly high in the air, but spends his time in the tree-tops or among the bushes.

The Oven bird has been called the Golden-crowned Thrush, but he is really one of the Warbler family. His coat is olive and he has a crown of orange color, set off by black stripes. His white breast is dotted with dark spots. The nest is built on the ground. It is made of coarse grasses, weeds and stalks and is covered at the top, the entrance being at the side. This peculiar form gives it the appearance of an old-fashioned Dutch oven, and from this fact comes the bird's name. The Oven bird has a louder note than some of the other Warblers, and John Burroughs, the student and lover of nature, likens its call to "*Teacher! Teacher!*" several times repeated and each time louder than before.

The Prothonotary Warbler is sometimes called the Golden Swamp Warbler. His head, neck and under parts are bright golden yellow; the wings and tail are slate colored. His nest is usually found on the shore of a stream or a pond or in a swamp, and is built in a tree cavity—a woodpecker's hole is often selected—or in some crevice. This Warbler is best known in the Gulf and central states, and rarely visits the North. He is a quiet bird and only occasionally sings his piping little song.

There are many other Warblers. The Yellow-breasted Chat is the largest of the family and sings more than most of his relatives. He is a good mimic and imitates the calls of the other birds, the mewling of a cat, the whining of a puppy and other sounds of animals. Then there is the Myrtle Warbler, so called because he feeds largely in the winter on myrtle-wax berries.

The Yellow Palm Warbler, the Magnolia Warbler—called by the Indians the Rain Bird, because his shrill song is prolonged when wet weather is approaching—the Cape May Warbler, the Canadian Warbler, the Black-throated Green Warbler, the Blackburnian Warbler, the Chestnut-sided Warbler, the Bay-breasted Warbler, the Black-poll Warbler, with a black cap on his head, the Pine Warbler—who builds his nest in evergreen woods, high up in the branches of a pine tree—the Prairie Warbler, the Parula Warbler, the Black-throated Blue Warbler, the Kentucky Warbler, the Cerulean Warbler—which has a beautiful blue coat, with a white breast—the Mourning Warbler, the Connecticut or Gray-headed Warbler, the Worm-eating Warbler, the Blue-winged Warbler, the Golden-winged Warbler, the Tennessee Warbler, the Nashville Warbler, the Orange-crowned Warbler, and others named for the bird-lovers who have pointed them out as a species distinct from the Warblers we have mentioned, are all members of this family.

You can see that it is a very large family. These pretty birds are found in different parts of the United States and Central America. Some are common and others are but rarely seen. All the Warblers lay white eggs, dotted with brown, or with brown and lavender. In some species, the eggs have a very faint blue or green tinge. In nearly all cases, their song is a cheerful whistle, not very loud and seldom long continued. Insects and berries make up their food, and they are as harmless as they are attractive.

### THE CARDINAL

AT FIRST glance it might be thought that the Cardinal, or Red-bird, is a near relative of the scarlet tanager, but he really belongs to another family, in which are found also the sparrows, the finches and the grosbeaks. He is a common bird in the South, and in summer is seen in the northern and middle states as well.

He is eight or nine inches long—larger than the tanager—and has a short beak, which resembles that of the grosbeak. His plumage is bright red, with a gray shading on the back, and his forehead and throat are black. This gay coloring, together with his large crest, gives him a very striking appearance. His mate has a coat of olive brown.

The Cardinal makes his home in the woods, and he prefers groves of evergreen trees near running water. His nest, which he usually places in a low tree or in a bush, is loosely made of twigs, vines and grass, lined with fine roots and hair. The eggs are blue or buff tinted, and marked with brown and purple. Corn is a favorite food of the Cardinal, and he likes cherries, apples and other fruit. He is also an insect-eater.

The song of the Cardinal is generally original, but at times he weaves into it the notes of other birds. It changes from a clear, mellow whistle to a soft, pathetic melody, and again to a loud, war-like strain, repeated over and over again. From his musical ability, he is sometimes called the Virginia Nightingale, and he is often captured and caged. He retains his cheerfulness in captivity, though his brilliant scarlet plumage usually fades to a lighter tint, and his songs are not so varied. Yet he does not droop and mourn for the woods, as the mocking-bird does, and if well cared for, often lives to be twenty or more years of age.



## THE GROSBEAKS

THE Grosbeaks derive their name from their large, strong bill, "gros" being a French word meaning great.

The Rose-breasted Grosbeak is a bird of the eastern United States, but goes as far north as Canada and the Northwest. The male bird is black above and white below, with some white spots on wings and tail, and has a beautiful rose-pink breast and wing linings. The female has a blackish brown coat, unrelieved by the rose color of the male's breast.

Ordinarily, the Rose Grosbeak builds only in the woods, but a pair of Grosbeaks will occasionally visit the city and nest in a fruit or shade tree. The nest is lightly put together and is composed of roots and twigs, lined with fine grass or pine needles. The eggs, four or five in number, are of a dark green color, spotted with brown and light shades of purple.

The Grosbeak is an attractive singer, and, like the mocking-bird, he gives vent to his pleasure while singing by fluttering his wings and tail. He, also, overflows with music to such an extent that he sings at night as well as during the day. His love of music is so much a part of himself that it is not repressed even by captivity.

He is very considerate, and to relieve his mate he often sits on the nest to give her an outing, yet while doing this he cannot refrain from singing. In this way he often betrays the whereabouts of the nest to the egg collector. His food consists of flies, mosquitoes, grasshoppers, crickets, seeds and the buds of trees. His stout bill enables him to crush large seeds and grains, and he is said to be the only native bird that will kill and eat potato beetles.

The Blue Grosbeak is a shy and solitary bird. He is found in the southern part of the United States, and in Mexico. His plumage is a rich dark blue, with more or less reddish brown or chestnut color on the wings. The female has a yellowish color on the wings, and her coat is yellowish brown, with dark buff underneath. The nest is built on a low bough or in a bush, at the edge of a wood or in a swampy thicket. It is built mainly of leaves and grass and lined with grass or hair. The eggs are pale blue.

The Evening Grosbeak is usually found only in Canada and the northwestern states. In the wilderness of western Canada, where man has not yet inspired him with terror, this bird is very tame, and sometimes hops about near a camp as though no harm could possibly come to him from that source. Brownish yellow is the prevailing tone in the bird's coat, with white on the upper wing







feathers and black on the outer wing feathers and the tail. The large bill is yellowish green in color. The Evening Grosbeak's song is a sweet warble, pitched in a low key, and bears some resemblance to that of the robin.

## THE TANAGERS

THE Tanagers are bright-hued birds of the tropics, where the abundant heat and moisture produce the brightest flowers, and lend the most glowing colors to the birds of that clime. The parrot, the cockatoo, the nonpareil and the flamingo are examples of the brilliant plumage found in the torrid zone.

In all there are three hundred species of the Tanager. In the tropics they are very abundant, but only two or three species visit the United States.

The Scarlet Tanager ranges farther north than any of the others, being common as far as Canada. His brilliant plumage renders him one of the most striking of American birds. He is a vivid flame of scarlet, as his coat flashes in and out among the green foliage. His gay costume is relieved somewhat by his wing and tail feathers, which are black. The female and the young birds have a coat of olive green.

The Scarlet Tanager is a shy bird and dwells in the depth of the woods, where he builds his nest on the horizontal limb of a tree, usually near the end of the branch. The nest is made of bark, twigs and roots, and is lined with fine roots and thin strips of bark, or pine needles. The four or five eggs are dull white, tinged with blue, and spotted with brown and lavender.

Beetles, bees and other insects are the favorite food of the Scarlet Tanager, to which he sometimes adds seeds and berries. His song is a pleasing warble, something like that of the robin; the note with which he calls his mate is a lively "Chip, chip-churr!" He is very fond of his little ones and cares for them faithfully.

The Summer Tanager has a coat of vermillion, without the black wings and tail which distinguish the Scarlet Tanager. The female wears a coat of olive green, with dull buff underneath. This bird does not range as far north as his scarlet cousin. He spends the winter in Central and South America.

He is not so shy as the Scarlet Tanager and often builds his nest in the garden or orchard. Sometimes it is found on the branch of a low tree near the roadside. The nest is a very thin, loosely built structure of grass and weeds, lined with fine grass or moss. The eggs are a faint green, spotted with brown and purple. The male



bird has a lively whistle, said to resemble that of the Baltimore oriole; the female utters a chattering call, which sounds like "Chicky, tucky, tuck!" rapidly repeated. Berries and insects are the food of the Summer Tanager, and his fondness for the stinging insects, like bees, wasps and hornets is so marked, that he is sometimes called the Red Bee-bird, as well as the Summer Red-bird. He is, however, of a family quite different from the real red-bird, or cardinal.

### THE NONPAREIL

THE Nonpareil is one of the names given to the brilliant-colored songster called by scientific bird-lovers the Painted Bunting. The name "Nonpareil" is derived from two French words which mean "no equal," because of the unequaled brilliancy of his coat. But the French-speaking people of his native Louisiana, also call him "la Pape," which means "The Pope," because he wears a blue or purple hood. His back is green, his throat and breast are scarlet, his tail brown, shaded with purple, and his head and neck blue. The female is olive green above and dull yellow underneath.

The Nonpareil is common in the states along the Gulf of Mexico and farther south in Mexico and Central America. He does not visit the northern states, except as a captive.

His nest is usually placed in a thicket or a hedge, never far above the ground. It is neatly made of twigs, roots and strips of thin bark. A lining of hair or fine grass is added, and then the nest is ready for the pretty eggs, which are white or pale blue, spotted at the larger end with purple brown.

The young birds are like their mother in their sober plumage, olive green above and pale yellow below, and the male Nonpareil does not get his final coat of brilliant colors until he is three years old.

The Nonpareil is coveted both for his cheerful warbling song and for his brilliant plumage. He is trapped and sent to the bird stores in the North and to countries across the sea. In his own home, he feeds on insects and various kinds of seeds, rice and ripe figs. He is not at all timid and often builds his nest near houses, and is always willing to join in a quarrel with other birds.

The Indigo Bunting, a cousin of the Nonpareil, breeds in the South, but ranges to the North, is common in Ontario, and is sometimes seen in New England. The male bird has a coat of rich indigo blue, with brown wings and tail edged with blue. Although he does not wear so many brilliant colors as the Nonpareil, he is a very beautiful bird. The female wears a suit of brown.

The nest and eggs are somewhat like those of the Nonpareil, and the nest is often built in the garden or orchard, as well as in the bushes along a road or at the edge of a meadow.

The Indigo Bunting is, however, a shy bird, and when he believes that he is watched, he flies off to the top of some tall tree, where he can feel safe. Here he perches on a twig and trills his pleasant song. The Buntings are likely to forsake their nest if the eggs are disturbed, and build a new one in a safer place, but after the little birds appear, they remain, even though molested, to defend and care for them. They bring to the young birds worms, seeds and grasshoppers in abundance, and if the little birds are taken from the nest and shut up in a cage, the parent birds will, if the cage be placed within their reach, remain in the neighborhood and continue to feed the little birds through their prison bars.

## THE SWALLOWS

THERE are nearly a hundred species of the Swallow in different parts of the world; in America we have only seven. All the birds of this family have remarkable wing powers. They fly very swiftly and dart through the air so fast that it is hard for the eye to follow their flight. They live almost wholly on insects and do not molest the grain. They have small bills, and small feet which serve them only for perching, as they neither swim in the water nor run on the ground. The Swallows are sociable in their nature. They travel together in large flocks and nest in the same vicinity. Two or three hundred nests are often found very near each other.

The Barn Swallow is one of our common birds. He has a coat of steel blue, with a bright chestnut color on his breast, throat and forehead. His long, forked tail serves him well as a rudder in his swift flight. The Barn Swallow builds his nest against a beam in the barn or some other outbuilding. It is made of pellets of mud, held together by grass, just as plaster has hair mixed into it for the same purpose. It has a soft lining of hay and feathers. Sometimes several families of Swallows build a row of nests along the same beam or rafter.

The Cliff Swallows build their nests in rows under the edge of a cliff, or, in a settled country, under the eaves of buildings, so that they are sometimes called Eave Swallows. The nest is made of mud, like that of the Barn Swallow, but is often shaped like a chemist's retort, or a gourd. The Cliff Swallow has a white forehead and there is a black spot on his chestnut-colored breast; underneath the feathers



are gray and on the upper parts steel blue; the tail is short and scarcely forked.

The Bank Swallow is sometimes called the Sand Martin. He is grayish brown, with a white throat and under parts, and is smaller than the Barn Swallow. To make his nest, he tunnels in a bank of sand or loose gravel, near a stream, and after carrying the burrow in for two or three feet, makes a wider chamber which he lines with grass and feathers. Bank Swallows dwell in colonies, and a sand bank is sometimes seen punctured with a score or more of holes which lead to their nests. During the breeding season, they never go far from home. When the young birds begin to appear from the nests, other birds, like the crow, watch for them and carry them off to eat, unless driven away by the older birds. Bank Swallows do not like to nest near the homes of men, as do the Barn and Cliff Swallows, and select, when they can, a sand bank on the steep shore of a river, where they are not likely to be discovered or attacked.

The Tree Swallow has a beautiful coat of steel blue, with a tinge of green on the wings and tail, and a white breast. Nature taught him to build a nest in some hollow tree,—perhaps the deserted hole of a woodpecker,—but he does not fear man and will occupy a box which seems to have been set up for the use of birds. Grass and straw are the materials of which the nest is built, and it is made soft with a lining of feathers. The Tree Swallow has been driven away from some of the eastern cities by the hostile English sparrow, which takes possession of the Swallow's nest and fights to retain it.

The Purple Martin belongs to the Swallow family. His coat is a beautiful purple black, with a brown tint on the wings and tail. His social habits differ from those of most of the species of the Swallow, in that he selects his home away from others of his kind. He is best pleased to find a nesting place provided for him in the dooryard, on a post or against the side of the house. He does not accept it so readily if it is fastened to a tree, for he likes to dart swiftly in and out, without the obstruction of the branches. He knows, too, that he must keep a sharp lookout for the robber sparrow, who watches for a chance to turn him out of house and home. In order to prevent this, the Martins sometimes take turns in guarding the nest, one remaining at home to fight the sparrows while the other goes for food. He attacks the hawk or the crow when he suspects him of coming to interfere with his nest.

After the young birds have been taught to use their wings, and it is time to think of going South for the winter, the Martins assemble in flocks and are as social as other Swallows. They become very much attached to their homes, however, and often return two or





BARN SWALLOW.  
 $\frac{7}{8}$  Life-size.





From col. Eugene Bliss.

CHIMNEY SWIFT.

$\frac{2}{3}$  Life-size.

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three days after they are supposed to have flown South, as if to say a last good-by to the place where they have raised their broods. They return year after year to the same nests, and if they find some earlier comers — bluebirds or pigeons, perhaps — in possession, they will drive them out if they can.

The eggs of the Purple Martin, the Tree Swallow and the Bank Swallow are white, without markings; those of the Barn and Cliff Swallows are speckled with brown and purple. The ordinary note of the Swallows is a cheerful sort of twittering, with which they always pay a greeting to the coming day; and while they do not sing a sustained song, like other birds, they are merry neighbors. They never molest our fruits and confine themselves almost without exception to insect food. The Purple Martin, which is the largest of the family, — from seven to eight inches in length, — eats large beetles, wasps and bumblebees, which he swallows whole; the other birds of the family are content with smaller insects.

### THE CHIMNEY SWIFT

THE Chimney Swift is often called a "Chimney Swallow," but he is not like other swallows in his anatomy and should not be classed with them.

This bird spends the winter in the South and from April to October visits the northern states. He is a small bird, a trifle more than five inches in length, but spends more time on the wing than other land birds, except, perhaps, the eagle. His coat is a blackish brown, lighter on the breast and throat and tinted with green in the upper feathers. His wings are very long for so small a bird, and measure twelve to thirteen inches from tip to tip. His feet are small and weak, and he does not perch on a branch as the other birds do, but clings to a vertical surface, with the help of his tail, which is tipped with feather-like spines and serves him as a prop, like the tail of the woodpecker.

The natural roosting-place of the Swifts is in a hollow tree or a cave, where they cling to the sides in great numbers, for they commonly live in colonies. When a flock of these birds is ready to alight in a favorite hollow tree, they circle about in the air, over the tree, in a funnel-shaped swarm, the lower end of the funnel descending little by little until the top of the tree is reached, when the whole flock gradually disappears within the trunk, the noise of their wings making a hollow rumbling sound like distant thunder. They enter the tree at twilight and leave it again the next morning,



rising in the same funnel-shaped cloud until all the birds of the flock have come out, and then they disperse to seek food.

In the same way, these strange birds make their roosting-places in chimneys, where they also build their nests. The nest is made of slender twigs woven together like the strands of a basket. The nest is fastened to the side of the chimney with a substance like glue, which comes from the bird's stomach. The nest has no lining, and is more like a shelf or bracket of basketwork than like the ordinary bird's nest.

On this rough shelf, four or five white eggs are laid, and when the young Swifts peep from the shell, the parent birds begin at once to feed them and give them constant attention. Sometimes a nest is loosened by the rain and falls to the bottom of the chimney, when the young birds crawl out from under the ruin and often cling to the side of the chimney for a week or ten days before they are old enough to fly. In the meantime, the parent birds bring them food just as if they were in the nest.

Swifts feed on small flies and other insects. Their food is caught on the wing, for they never descend willingly to the ground and are never seen to alight on the branches of trees.

These birds are among the most interesting of our feathered friends, because of their remarkable habits. They do not sing, but make a little twittering sound as they fly.

## THE HONEY-GUIDE

A BIRD that has a sweet tooth and can induce man to gratify his appetite for honey, without much trouble to himself, is the Honey-guide, or Indicator. This bird is found in Africa and in India, and instead of flying away from man in fright, he depends on man to get for him the honey which is out of his own reach. There are several species of Honey-guides, but the true or common Honey-guide is a small bird, about the size of a sparrow, with a grayish-brown coat, white ear-tufts and a brown and white tail. Some species, it is believed, do not build a nest, and the female lays her white eggs in the nests of other birds, like the disreputable cuckoo. Other species, however, nest in holes of trees, and both the parent birds sit on the eggs. These birds live only in pairs and are never seen in flocks. Usually, in fact, they are seen singly, except in the mating season.

Honey is the food for which this bird is constantly searching. Wild bees usually live in a hollow tree and the Honey-guide follows

the bees through the forest, to learn where they have their hive. When he has located the tree, he flies to the nearest camp or village and sets up a lively chattering, at the same time flying about in a state of great excitement, in order to attract the attention of people near by. The natives never neglect his pleadings and immediately start to follow the bird. He leads the way through the forest, flying ahead for a short distance and then looking back to make sure he is followed. The natives whistle in response to his calls and let him lead them where he will. At length the bird alights on a tree and declines to go farther. Then those who have followed him know that the bees' hive is near—perhaps in the tree on which the bird has alighted.

The bees leave only a small hole in the trunk of the tree, through which to pass in and out, but when a bee returning to the hive with honey comes along, the hunters, by watching him, locate the nest. Then they climb the tree, knock out the mud with which the bees plastered up the hole in the tree trunk, and light a fire of dry grass. The angry bees come swarming out only to have their wings scorched in the flame and fall helpless on the ground.

The combs full of honey are soon taken from the nest and then the Honey-guide gets his reward. A generous piece of comb is left on a bush or on the ground, and the bird, knowing this is meant for him, immediately begins his feast upon it. The natives never take the honey from a bees' nest without leaving a portion for the Honey-guide, for they believe that if they cheat him of his reward, he will come some other time and lead them to the den of a lion or deadly snake.

Travelers say that the Honey-guide in this way does sometimes deceive those who follow him, and instead of a bees' hive the hunter finds a crouching leopard, but it may be that the bird, which, of course, does not fear the wild animals, is intent only on honey, and sees no reason to turn aside from fierce beasts which may be in the path.

At any rate, the Honey-guide shows remarkable intelligence in first attracting the attention of men for a definite purpose and then leading them to rob the bees' hive, which he cannot get at without assistance. It has been stated that sometimes the bird does succeed in breaking into a bees' hive, and he has been found, stung to death and covered over—embalmed, so to speak—with wax, which the bees placed around him in order that their home might not be made uninhabitable by the decaying body.



## THE WAXWING

THE Cedar Waxwing, also called Cedar Bird and Cherry Bird, is common throughout North America. It is a bird of wandering habits and cannot be depended upon to appear in the same locality two years in succession. He seems to be a sort of gipsy of the air, who does not become attached to particular places. His plumage is cinnamon brown on the back, yellow or slaty underneath, and through each eye is a line of deep black. The wings and tail are of slate color, the tail tipped with bright yellow, while at the tips of the "secondary" or shorter wing feathers appear little hard substances which look like drops of bright red sealing-wax. From this fact comes the name "Waxwing." At the top of the head is a crest of brown feathers that are as soft as silk.

The Waxwing is a gentle bird and fond of society. He makes little noise, moving about very quietly and attracting no attention. These birds live together in large numbers and fly from place to place in a compact mass. When they alight, they remain close together, and as many as can do so, perch on a single branch.

The nest is built in a cedar or hemlock tree, or sometimes in a fruit tree, ten or twelve feet above the ground. It is much larger than the nests built by other birds of like size, and is composed of branches, twigs and grass, loosely put together and lined with hair or feathers. The four or five eggs are dull white or bluish gray, dotted and streaked with violet and brown, and are very pretty.

The Waxwing is fond of fruits and berries, especially those that are juicy, and his liking for cherries has caused him to be sometimes called the Cherry Bird. In autumn, he feeds on juniper berries, persimmons and grapes. Insects are also his prey, and he fully atones for his invasions of the fruit crop by destroying large numbers of the cankerworm, which is the scourge of the orchard. If an unusually large pest of insects appears in a locality, the Waxwing is often the salvation of the fruit crop, for he discovers them, and proves a most effectual agent in destroying them.

The Bohemian Waxwing is a European as well as American bird. He is much like our own Cherry Bird, but larger and differing slightly in color. He has the same silky plumage, however, and in Europe is often called the Silk-tail. He is a real Bohemian, wandering from place to place and being found one year in one country and the following year in some other country, hundreds of miles distant. He is usually to be found in birch and pine forests. As far north as Manitoba he often remains throughout the entire winter. He shows









no fear of man, and during the winter season appears in the streets in search of food.

His habits in nesting and in selecting his food show that he is a near cousin of the Cedar Waxwing.

With their quiet habits, it is not to be expected that Waxwings would be songsters, and their only note is a lisping call, something like a hissing or twittering sound.

The Cedar Waxwing has the most amiable disposition, and his friendly relations with his little neighbors are a model for society. Some other birds quarrel with all except their individual mates, and some indeed are given to domestic embroilments. The Sparrow, particularly, might learn a lesson from the gentle Waxwing.

## FLYCATCHERS

TO THE family of Flycatchers belong several birds called by other names, like the Kingbird, the Phoebe and the Pewee. The Flycatchers have broad, flat bills and open their mouths very wide when seizing the insects which are their prey.

The Kingbird is the best known of the Flycatchers. He is found throughout the eastern and middle United States and in Canada, but is rare west of the Rocky Mountains. He is eight inches long and has a dark gray coat, almost black on the head; white underneath, with tinges of gray on the breast; a black tail with a broad, white tip. If you can take him in your hand and lift up the dark feathers on his crown, you will find orange or yellow feathers concealed there.

The Kingbird spends the winter in the warm regions of Central and South America, and returns to the United States in the spring. In May or June, he builds a nest in the orchard or in the woods, on a horizontal tree branch. The nest is made of moss, roots and coarse grass stalks, closely woven, and filled in with plant-down or wool. The lining is of horsehair or fine grass and feathers. The eggs, four or five in number, are buff white, with large spots of light and dark brown.

The Kingbird is not a songster. He rarely utters more than a sharp, shrill call, although this is sometimes repeated and continued into a sort of song. His food during the summer is mostly confined to insects, but when autumn brings the berries and fruits, he will vary his diet with them.

Among the insects, the Kingbird is a dangerous bird of prey. From his perch on the top branch of a tree, he darts after an insect as it



passes, snapping it up and returning to wait for another victim, or he circles over the fields, like a hawk on the lookout for larger game.

From his name, it might be supposed that he was a large and powerful bird; it was given him really because of the great courage he shows in a fight. He is very fond of his mate and young birds, and defends them bravely against their enemies. He does not always wait to be attacked, but offers battle to any suspicious character in the bird world who seems to be spying out his nest or thinking of a descent upon it. The crow and the jay he attacks bravely, darting at them now from above and now from beneath, and rarely fails to overcome them. His courageous assault often puts larger birds, even the eagle and the hawk, to flight. He has been called a tyrant, because of his fighting qualities and the belief that he attacks other birds without provocation, but those who have watched him carefully say that he quarrels only with his natural enemies who are also watching for a chance to rob his nest; and usually they are larger birds than himself.

The Kingbird has been called the Bee Martin, and honey-growers have accused him of eating the bees about their hives; but an examination of the stomachs of two hundred and eighteen Kingbirds proved that only fourteen of them had eaten bees, and the bees were mostly drones—not the workers who make honey. The truth is, he is a harmless bird, and is useful in destroying insects and driving away crows and hawks from the fields and farmyards, so we have reason to think well of the Kingbird.

Nearly all the Flycatchers are accustomed to make long migrations, in order to have a constant supply of insect food; but the Phoebe, who belongs to this family of birds, remains in the southern states throughout the winter.

The Phoebe gets his name from his characteristic call of "Phee-bee! Phee-bee!" sometimes rapidly uttered and at other times given in a sad, plaintive tone, "Phee, bee-e, phee-bee!" This call is varied at times to "Pe-wit!" so that this bird is also called Pewit or Pewee.

His plumage is olive brown on the upper parts and white or faint yellow underneath. Around his eyes is a white ring and his bill and feet are black. A very slight crest appears on his head.

The Phoebe usually nests near streams and ponds, and the nest is built under a bridge, in a cave or in a barn. He has been known to build in a well. The nest is made of roots and moss, cemented with mud and lined with grass and feathers. It is attached to the side of the stonework or beam. When the Phoebe has once found a favorable nesting-place, he dislikes to leave it, and even if the nest be torn

down, he will rebuild in the same place or near it. The nest is quite large, to accommodate the four or five young birds which come from the white, brown-speckled eggs.

The Wood Pewee builds his nest on the branch of a tree. It is neatly made of grass and roots, which are held together with caterpillars' silk and cobwebs. Fine moss is used to line it, and the outside is covered with lichens, so that it resembles the bark of the tree in color and texture. The eggs are white, with a wreath of brown and purple spots at the larger end. The Pewee is one of the most expert of the Flycatchers and in the early dawn and at dusk, when insects are less active than in the middle of the day, he may be seen darting about in pursuit of his prey, with keen activity. In appearance, the Wood Pewee somewhat resembles the Phœbe.

The Least Flycatcher, or Chebec, is smaller than the other Flycatchers, but resembles some of them in appearance and habits. He may build his nest in the garden or orchard, for he does not seem to fear man; but oftener he is found in deep woods.

The Vermilion Flycatcher is a little fellow, found only in the extreme southern states and in the warmer countries beyond. He differs from the other birds of the family in having a brilliant red crest, which is as large as that of the Kingbird, and a breast of the same color.

The Scissors-tailed Flycatcher, or Texan Bird of Paradise, is another Southern bird. His head and breast are grayish white, with a touch of crimson under the slight crest. His wings are dusky and his under parts reddish. His remarkable tail is twice as long as his body, and forks near the base, giving the tail the form of a wide-open pair of scissors.

While the food of the Flycatchers is chiefly insects, they also eat berries to some extent. They are not singing birds, but their calls are characteristic and interesting.

## WEAVERS

THERE are several species of birds in the family of Weavers. They are found chiefly in Africa, to some extent in Asia and Australia, but never in Europe or America.

The Weavers resemble our oriole in their nest-building habits, although the former build nests which are much more wonderful than any made by the oriole.

The Philippine Weaver-bird weaves a stout rope which he fastens to the end of a tree branch. Starting with this, he builds a round



chamber, and below it a long tube through which he enters the nest. It is something like a stocking hung upside down, with the nest in the toe and the entrance through the leg. It usually hangs at the tip of a branch projecting over the water, so that snakes, monkeys and other enemies cannot get at it. Sometimes the nest is attached to the old one of the year before, and so on for several years, until there is a long string of nests dangling from the tree. The Weaver-birds derive their name from the skill displayed in weaving grasses, roots, hair and other things into a strong fiber.

The most remarkable of the family, however, is the Republican Weaver-bird, or Sociable Grosbeak, found in South Africa. These birds join in colonies of from two to three hundred. They select an acacia tree, whose smooth stem renders climbing difficult. At a safe distance above the ground, they build a straw roof, shaped like the top of an umbrella. It is carefully woven and will shed water as well as the thatch of a native hut, which it closely resembles, when viewed from a distance. The sloping sides of the roof are so slippery that any animal attempting to get at the eggs or young birds in the nests underneath would be unable to keep his foothold.

The nests are fastened to the under side of the roof, where they cluster as thickly as possible, with the openings at the bottom. Several hundred nests have been found attached to one of these roofs, and a roof is sometimes pulled to the ground with the combined weight of the little tenements. The nests are arranged in regular order like the cells of a honeycomb and each year new ones are attached to those of the previous season.

The Weaver-birds are about the size of sparrows. The females are dressed in plain brown and the males have a similar coat in autumn and winter. When spring comes, however, the males of some are dressed in crimson or golden-yellow plumage, with markings of black, but the plumage of the Sociable Grosbeak or Weaver-bird is exceptionally dull.

## THE RUBY-THROATED HUMMING-BIRD

“Is it a gem, half bird?

Or is it a bird, half gem?”

IT is rather the incarnation of a rainbow—all color and animation. The Humming-bird leads the most aërial life. He is almost always on the wing, sipping nectar from the fairy cups of the blossoms. His radiant vivacity and intense enjoyment of existence make him seem like a little being escaped from Paradise. The male

seems to be a little bundle of activity. His audacity is in absurd proportion to his size. He does not hesitate to attack a bird twenty times as large as himself. Fastening upon the object of his anger, he allows himself to be carried along in the flight, while he pecks savagely until his impotent wrath is appeased. If he approaches a blossom and finds it wilted, the vindictive little creature tears the petals to shreds.

The Humming-birds are exclusively American, and are found in both Americas, from Canada to Patagonia. There are nearly five hundred species of birds belonging to the family of "Hummers," about fifteen of which, however, are properly birds of the United States. They range in size from the proportions of a large bumblebee to those of a sparrow. They are found in greatest variety in the tropics.

The Ruby-throated Humming-bird is the one with which we are familiar in this country. What a dainty, exquisite creature he is. His upper plumage is lustrous green; his wings and tail of bronze violet; his chin black; his throat of the richest ruby; his breast white. The female has a gray throat, her tail feathers barred with black and the outer ones white at the tips.

With his long, slender bill, he probes the heart of every flower to extract its honey. This honey and the tiny insects found on plants are his chief subsistence, although he occasionally varies his bill of fare with flies and spiders.

The Ruby-throat builds his nest on a horizontal branch or in the crotch of a tree. The most exquisite workmanship is displayed in the construction of this nest. The fairy fabrics that enter into it are selected with great care. The down of plants like the thistle and the mullein are bound together with spiders' webs covered outside with gray lichens, which are glued to the nest so artfully that it seems to be an excrescence of the branch to which it is attached.

The nest completed, two pearly white eggs which are about half an inch in length, appear. In ten days the little Humming-birds peep from the shell. They are not much larger than sprawling beetles. The parent birds feed them by thrusting their long bills down the throats of the little ones and pumping honey from their crops into those of the little new arrivals.

Have you ever seen a Humming-bird at rest? Probably not, for their nests are so small and so seldom seen, and they are quiet so little of the time when away from the nest, that usually, when we notice them, they are darting about from flower to flower, poising in the air before one, sipping its honey, and then moving on to the next, without pausing for a rest. It is hard to count the wing strokes of a slow-flying bird, but think of the wonderful rapidity of the Humming-bird's wing strokes, which we cannot even see. All



that we do see is a confused something, like a mist of blue, on either side of the tiny creature, where we know the wings are beating up and down with lightning-like speed. It is the noise made by these rapidly-moving wings that gives the bird his name, for it is like the hum or drone of a bee.

Humming-birds soon die in captivity. They are so restless, and constant activity is so natural to them, that the restraint of a cage causes them to droop and mope until they pine away. But they are not timid creatures, and if a saucer of honey or sweetened water be placed on a window-sill, they will come regularly to it to feed. Apparently without thought of being captured, they will fly in at the open window of a dwelling or a greenhouse where they see flowers in bloom.

In the tropics, many species of the Humming-bird are found, nearly all of which have brilliant plumage. Some have bills slightly curved upward, and the Sickle-bill Humming-bird has a bill curved downward so as to form nearly half a circle, which enables him to reach the honey of flowers that have a similarly curved corolla.

## THE PEACOCK

THERE are two distinct species of the Peafowl, both of which are natives of Asia, of which the Common or Crested Peafowl is best known. They were first found in the islands of the East Indies, and their beautiful plumage attracted so much admiration, that they were introduced into all parts of the world. In the Bible we read that they were taken to Palestine by the fleets of King Solomon. They were common among the Greeks and Romans, and to-day are well known throughout America.

Next to the turkey, the Peafowl is the largest of the birds that are classed as poultry. The gorgeous plumage is confined to the male bird or Peacock, while the female, or Peahen, is more plainly dressed.

The Peacock is the most ornamental of all the domestic birds. With his sweeping train and graceful, mincing steps, he reminds one of a stately dame treading the minuet. The tail, outspread like a gorgeous fan, or trailing over the lawn as if to erase the imprints of his dainty steps, is his principal ornament. Iridescent reflections gleam over his plumage like the hues flashing over the angles of a prism.

The Peacock's head and neck are covered with bright green feathers, while on his breast is a beautiful shade known as pea-



FROM COL. F. M. WOODRUFF.

RUBY-THROATED HUMMING BIRDS.  
Life-size.

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cock blue. The head is surmounted by a crest of twenty-four stiff, upright feathers, with slender shafts and broad tips. The real tail is very short and is made up of eighteen stiff, brown feathers. Over the tail extends the magnificent train of feathers, sometimes five feet in length. Ordinarily, these long feathers extend horizontally behind the bird, but when he is pleased or wishes to display his beauty, he raises them to a vertical position, and uses his short tail feathers to support them.

Beautiful shades of brown, golden purple and green mingle and glimmer in the Peacock's feathers. When raised, the train forms a disk which displays the colors of the plumage to great advantage. The feathers of the train overlap each other, those nearest the head being shortest, and when the train is raised, the "eye" near the end of each feather is plainly shown. The longest feathers lack these spots, but their tips are barbed or forked to form a border around the disk.

In the mythology of ancient Greece, Hera, the wife of Zeus, becoming jealous of a maiden named Io, changed her into a heifer, about which buzzed a tormenting gadfly. The many-eyed Argus, who was set to watch the heifer, was slain by Hermes, whereupon Hera fixed his eyes in the tail of the Peacock.

The Peacock is conscious of his charms, and tries to excite admiration by displaying his gorgeous train. He struts about with stately mien, apparently well pleased with the imposing effect of this parade.

According to the usual plan in bird life, the Peahen is smaller than her mate, and wears no train, while her plumage is grayish brown, except for the green feathers on the neck.

This bird is common in India, and in the jungle is often found in the neighborhood of a tiger. The hunter who encounters a wild peacock should be on the lookout for the dangerous beast of prey.

The Peacock makes a nest on the ground, which is but a hollow lined with leaves, like that of the turkey. The female lays from twelve to twenty eggs, about as large as those of the goose, and raises only one brood in the year.

Peacocks are easily domesticated and become very tame, but they do not like confinement, and need a wide range. Rejecting the shelter of a house, they perch on trees during the night. The Peahen is not a careful mother, and often neglects her eggs, so that it may be necessary to coax a hen turkey to sit on them till the Peachicks are hatched.

Grain, seeds and insects are the favorite food of the Peafowl. He does not object to the society of the turkey, but is less kindly



disposed toward his other companions of the poultry yard and sometimes kills young chickens.

The Peacock has stout legs, which enable him to run swiftly. He can fly, too, but when out in the rain his great train of feathers becomes so heavy with water, that he cannot easily rise from the ground, and must wait for the feathers to dry before he can take wing.

Beautiful though he is, the Peacock has a harsh, loud cry, which grates unpleasantly on the ear, and when a number of Peafowls are screaming in chorus, the discordant sound is deafening.

The flesh of the Peafowl is sometimes eaten, though not very appetizing, for it is likely to be dry and tough. The ancient Romans, however, seldom gave a grand feast without having several dishes made of Peacocks' tongues and brains, which were considered a great dainty. Sometimes a bird was cooked whole and the skin, which had been carefully removed, was placed about it when it appeared on the table, making a gorgeous ornament before it was carved.

The Peacock is easily raised, and, where he has ample ground over which to roam, thrives well and is an attractive ornament to the lawn or garden.

## THE LYRE BIRD

THE Lyre Bird of Australia is chiefly remarkable for his beautiful tail. His delicate sprays of branching feathers would suggest a possible relation with the bird of paradise, though he lacks the beautiful colors of that bird; neither does he resemble the crow family, for he is a song-bird, and by some naturalists is classed among the wrens.

The Lyre Bird is about as large as a pheasant; that is to say, his body is fifteen to eighteen inches long, while his ornamental tail is often twenty-five inches in length. His coat is a dusky brown, with a reddish tinge on the throat, chin and some of the tail feathers. A slight crest surmounts the head, which is bare of feathers about the eyes. His remarkable tail gives him his name. The two outer feathers have a narrow web on the outside, and a broad one on the inside. They curve first out, then in, then out again, like the sides of the ancient musical instrument called a lyre. The two middle feathers are very slender and curving. The other twelve feathers have long, loose barbs, but no web, so that they make a sort of background for the other feathers, like the web of a spider. This elaborate tail does not reach its full growth until the bird is three or four years old.

The Lyre Bird spends most of his time on the ground where, like the hen and the turkey, he scratches the earth, to turn up slugs and



FROM COL. F. KAEMPFER.

LYRE BIRD.  
1-5 Lite-size.

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RED BIRD OF PARADISE.  
+ 9 Life-size.

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insects. These constitute the greater part of his food. He runs swiftly in the brush, but is rarely seen on the wing, for, as a rule, he flies only to escape some swift pursuer.

His nest, which is placed on the ground near the foot of a tree or against the side of a rock, resembles a little dome-shaped hut. It is made of twigs, leaves and moss, and is covered at the top, the entrance being at the side. The female lays only one egg, which is as large as a small hen's egg. In color it is dusky purple, spotted with still darker purplish brown.

The Lyre Bird has a peculiar trait of building small round hillocks, which he mounts at intervals during the day. There he spreads his tail and droops his wings, while he stretches and pecks at the ground, uttering various calls. He sings mostly in the morning and again in the evening, and remains quiet in the middle of the day. His song is pleasing, and it is said that the Lyre Bird can imitate the notes of other birds with the degree of perfection that marks our mocking-bird. He is the largest song-bird in existence.

There are only two or three species of the Lyre Bird, and none of them has ever been found outside of Australia. Even there they are rarely seen, for their natural shyness usually leads them to keep well hidden in the brush. They do not live together in flocks, but in pairs, and for that reason it is seldom that more than two are near at one time. They shun settled country, and are gradually disappearing before the march of civilization.

## BIRDS OF PARADISE

THE wonderful Birds of Paradise are among the most beautiful of the brilliant-hued birds. In beauty of coloring, grace of form and delicacy of texture, their plumage has no equal in the bird kingdom. These birds are native only in the Malay Archipelago, and most of the best-known species come from the island of New Guinea. They are peculiarly adapted to the torrid zone, and do not long survive a change of climate.

When we look at their beautiful family, it is hard to realize that the birds are nearly related to the crow family; yet such is the truth, for in the shape of their bills and feet, in their habits, and even in their voices, they strongly resemble the crow. Their "caw," however, is more musical than that of the black-coated bird.

These birds are active and intelligent. They pass their time in the trees, descending to the ground only when it is necessary to secure food. Their diet consists of grains, figs, fruits, grasshoppers and



other insects, and they are hearty eaters. They preen their beautiful plumage with the utmost care, and guard their long delicate sprays of feathers, to keep them from stain or soil, and perch high to avoid breaking them by contact with the branches.

Their bearing is in harmony with their lovely plumage. Their manner combines the elegance and airy grace of the true Parisian. They are lively and evidently fond of society, as they live in flocks. They often parade on the high boughs of a tree, spreading out their plumage, while their Quaker-like wives gaze in admiration at the gorgeous plumage of their lords and masters, for the Birds of Paradise are no exception to the decree of fashion among birds that the male shall wear the gay attire. The females are ordinary-looking birds, usually of a dusky-brown color, and have no plumes.

One would think that his plumage had suggested the name given to this bird, though in truth it is derived from a superstition. At one time people were always ready to ascribe anything unusual to a supernatural cause. When the first European traders went to the Malay Islands, the natives sold them the beautiful skins of these birds, after removing the wings and feet, which they buried, in order to appease some offended deity. As the birds seemed to have no means of flying or perching, the Europeans at once drew their own conclusions, spreading marvelous tales, which were readily accepted by the credulous folk of that time.

It was believed that these birds passed their lives floating in the air, and never descended to the earth, until death robbed the beautiful bodies of their floating essence. Their abode was thought to be in the sun and in the highest heavens, and it was reported that their food was dew from heaven and the nectar of flowers. The natives told the traders that the birds hung from trees at night by means of their delicate tail feathers. People believed all these fabulous reports, and as the birds seemed to be connected with heaven, they were called "Birds of Paradise."

The natives kill these beautiful birds by shooting them with blunt-headed arrows, so that no blood may be spilled on their delicate feathers, and afterward dry the skins with the smoke of sulphur. This dulls the brilliant colors of the feathers, so that those who have never seen the living Bird of Paradise can hardly realize how beautiful his plumage is.

The Great Bird of Paradise is the largest of this family. His length is usually about eighteen inches. The coat is chiefly a rich brown, deepening to purplish brown on the breast. The top of the head and the neck are covered with short, thickly set feathers of a pale yellow color. So soft are they and so closely set, that the head seems to

be covered with straw-colored velvet. The eyes are bright yellow, and underneath them and over the throat the feathers are a rich green. From under the wings grow a large number of feathers, two feet or more in length, which are loosely webbed and vary in color from orange to white. The two middle tail feathers are almost entirely unwebbed and extend in graceful curves over the other plumes. The bird can raise these long plumes so as to cover his body when he desires.

The Red Bird of Paradise is much like the bird just described, but the long plumes, which in the Great Bird of Paradise are orange yellow, in this bird are rich crimson.

The King Bird of Paradise is one of the smallest of the family, but, nevertheless, one of the most beautiful. He is about six inches in length. His coat is a beautiful crimson, with a bar of green on the breast and white underneath. From each side of his body, near the wing, grows a tuft of feathers of slate color, tipped with rich green, and he can spread these feathers out like a fan. The two middle tail feathers extend beyond the rest of the tail like two slender, gracefully curved wires, and at the end of each, on the inside, is a web of green feathers, which curves on itself so as to form a ring.

The Superb Bird of Paradise has a head and neck of greenish gold, with a black crest, and general color above, velvety black.

The feathers of the head, neck and breast overlap each other like fish scales, and give the plumage a striking appearance. The tail and wings are black, the throat purple and the under parts green. Over the back rise beautiful black plumes, thickly set, which spread out like a second pair of wings. This Bird of Paradise is notable for not having tail plumes of great length, like most of the other species.

The Gold-breasted or Six-shafted Bird of Paradise has a black, green, golden and violet plumage, and from either side of his head three long feathers, without web, except at the end, extend over his back.

The Twelve-wired Bird of Paradise has a dark coat and pale yellow plumes, against which appear twelve long curving feathers that have no webs. These long, curving, wire-like feathers extend beyond the plumes and intermingle with each other.

It is impossible to describe the beautiful plumage of all these birds, and no one who has not seen them can realize how wonderfully nature has adorned these beauties of the feathered tribe.



## PARROTS

PEOPLE who are fond of Parrots usually think they are the finest birds in the world; and people who are not fond of them think they are the greatest nuisance. A Parrot often serves to make amusement by repeating words and phrases that have been taught him, but is noisy and usually ill-tempered, and screams so loudly and harshly that he is not adapted to be a welcome pet in a household where there are nervous people.

But Parrots have interested men for many centuries. In the days of the ancient Roman Empire, these birds were kept by the nobility in costly cages made of ivory, with silver and gold wires. They were also served as a delicacy at the table.

The Parrot family includes about four hundred and thirty different species, nearly all of which are found in the tropical regions. A few species, however, exist in Australia and New Zealand, and we have in our own country the Carolina Parrot, which is found in the southern states. The little Love-birds, which belong to this family, are no larger than sparrows, and Parrots vary from that size up to the great Macaw, which reaches a length of three feet and is strong enough to bite one's finger off almost as easily as if it were a straw.

All Parrots have certain family characteristics. The beak is short and stout, and the upper half curves down over the lower, ending in a hook. The two parts of the bill swing on hinges, and make it possible for the bird to bite very hard with them, so that he can easily crack a thick-shelled nut. His tongue is thick and long, and black in color. The Parrot has four toes, two of which point forward and two backward. This gives him a firm hold on his perch. He sometimes uses one foot to carry his food to his mouth, and uses his beak, as well as his feet, in climbing. His feet are covered with scales and his wings are short. His voice is usually very harsh and grating.

It is his voice, however, that makes the Parrot an amusing pet. All the birds of this family have the faculty of imitating the human voice to a greater or less degree, and if taught to "talk" when young, will pick up many phrases, which they repeat whenever the fancy seizes them. A great many stories are told about funny happenings due to the Parrot's ability to talk. Some of these stories are true, of course, but a great many of them, which represent that the Parrot's speech could not be distinguished from that of a person, are not true. However distinctly a Parrot may repeat words and phrases, his voice could scarcely be mistaken for that of a person, except, perhaps, by a dog or a cat.

Parrots spend most of their time in trees, screaming and making a great confusion. They make their nests in hollows in trees or stumps, and their eggs are usually white.

Most of the Parrots have very brilliant plumage, in which blue, green, red and yellow are mingled. The best talker of the Parrot-world, however, is very plainly dressed. This is the African Gray Parrot. He has gray plumage, his only other color being the red of his short tail. He is an intelligent bird and can whistle a tune very cleverly. In their home in the forests of Africa, these birds live in great flocks, feeding on fruits and grains; and they often do great damage to the crops of the farmers.

In New Zealand and Australia, we find the "Owl Parrots," so called because they have disks about their eyes, fly abroad at night, and in other ways resemble the owls. The New Zealand Owl Parrot or Kakapo is an intelligent and good-tempered bird. He makes his nest in a hole in the ground or under a fallen tree. He cannot fly well. Roots, leaves and tender twigs are his usual diet. His coat is green, marked with yellow and black.

The Cockatoos are interesting members of the Parrot family. They are easily recognized by their crests, and from the fact that white, black or brown is the general color of their plumage, while other Parrots are more gaudily dressed. There are thirty-two species of birds included in the family of Cockatoos. Of the fifteen species which are true Cockatoos, all but two have white plumage. The Black Cockatoo is the largest of all the Parrots, if we do not consider the length of the tail. If that is taken into account, the Macaw is larger.

The Bat Parrots are odd members of this family of birds. They do not talk and are not strong on the wing, but jump about in the branches of the trees. When they sleep, and sometimes when they eat, they hang head downward, with their toes firmly clasping the perch. These little birds are easily tamed and are affectionate in disposition. They are found in China and the Malay Archipelago.

The Lories are birds of very brilliant colors and delight in uttering deafening screams. The birds which belong to this group are especially fond of the honey of flowers, but they also eat insects and soft fruits. One of the most beautiful of these birds is the Red Lory, which has plumage of brilliant scarlet and blue. This bird is found in the Moluccas. In Australia we find the Blue Lory, whose plumage is green, red, yellow and blue. He is a noisy and quarrelsome bird.

The Macaws are the largest of the Parrot family. The Hyacinth Macaw, whose home is in Brazil, is three feet in length. His general color is blue, with yellow about the eyes and chin. The great



Scarlet Macaw has red plumage, with blue and yellow on his wings and tail. These birds are noisy and ill-tempered. They do not talk well and are not agreeable pets. They nest in hollow trees and the female lays two white eggs. She hatches two broods each season.

The Double Yellow-headed Parrot, which comes from Mexico, is easily tamed and is a good singer. His plumage is dark green, with red and blue edges on the wing and tail feathers. The yellow spot on his head extends as he grows older; and when he is four or five years old, his head and neck are entirely covered with a yellow hood.

Paroquet or Parrakeet is the name given to birds which are really small Parrots with long tails. They are similar to Parrots in their plumage and habits, although but few species talk. Mexican Paroquets are often seen in the cages of the bird-sellers. They are fluffy, pretty little creatures, but do not talk. Paroquets should be kept in pairs, for they are very fond of each other's society, and if one of a pair dies, the other will not long survive.

The Carolina Parrot is the only bird of the family that is found wild in the United States. Years ago this bird was common throughout the southern states, but is now found only in a few localities in Texas, Florida and portions of adjoining states. His head and neck are yellow, with a patch of orange on the side of the head. The rest of his plumage is green, with yellow and orange tips to the wing-feathers. In a general way, he resembles the Mexican Double Yellow-headed Parrot, but has a longer tail.

These birds are affectionate in disposition and if one is sick or wounded, the other Parrots in the flock defend and care for him. They live in flocks and keep up a great chattering; though they are not "talkers" and cannot imitate human speech. Fruits, nuts and seeds are their chief items of food. It seems a pity that the only species of Parrot we have in this country should become extinct, but the craze for bright feathers in women's hats has made these birds valuable to the feather hunters and they have been killed off until but few remain. In their native state, some Parrots are believed to live to a great age, sometimes seventy or eighty years.

## THE TOUCANS

THE Toucans are among the most remarkable birds of the New World. They are found only in the tropical regions of the Western Hemisphere, chiefly in Brazil.

Their most remarkable feature is the great bill, which in some species is as wide as the head at the base and is half as long as



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DOUBLE YELLOW-HEADED PARROT.  
1/2. Life-size.

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YELLOW THROATED TOUCAN.  
 $\frac{1}{2}$  Life size

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the body. This great bill looks so unwieldy that you wonder how the bird can sustain such a weight; but as a matter of fact, the bill is not heavy at all. On the contrary it is very light, for it is filled with little cells, or air holes, like a piece of honeycomb. It is strong, however, and with it the Toucan can kill a small bird with one squeeze. The bill is curved toward the tip and has saw-tooth edges. While the bird lives, the bill usually has brilliant coloring, yellow, green, purple or red, but after he is killed, the bill loses these colors and changes to dark hues. The Toucan's tongue is no less remarkable. It is very long and narrow, and on each side has a series of barbs which seem to be for the purpose of increasing the bird's power of tasting.

The Toucans eat almost everything. Fruits, fish, eggs, insects and reptiles vanish quickly down the wide throat, and small birds aid in satisfying their remarkable appetite. In eating, they take their food in their bills, taste it with their tongues, then throw back their heads with a jerk and dispose of the morsel at one swallow. Like the owls and parrots, the Toucans build their nests in holes in hollow trees, and the female lays two round white eggs. Usually Toucans are found living together in small flocks. They spend most of their time in trees, and, when perching, have a habit of throwing the tail upward and forward over the back, so that the tip points toward the bird's head.

There are over fifty species of Toucans and the colors of the plumage differ in different species, although they are brilliant in all. These birds also vary somewhat in size, the smallest being no larger than a robin, while others are two feet in length. The Yellow-throated Toucan has a yellow throat, with some red on the breast and the under parts, and the remainder of the plumage black and yellow underneath, with a band of rich crimson across the breast.

Toucans may easily be tamed and seem entirely satisfied to live in captivity, if they are given enough to eat. They have a trick of snapping their bills together in such a way as to produce a clattering noise and at times utter a harsh cry, something like that of a parrot, but, on the whole, they are more interesting than parrots, except that they do not "talk."

Their brilliant feathers are sought by hunters, and the flesh is edible, although rather tough. Near cultivated plantations, they often do considerable damage to fruit and are shot as a nuisance. When they go abroad in search of food, they usually post one of their number as a sentinel, to keep a lookout for enemies, and it is from the sentinel's warning cry of "Tu-can-o" that the bird gets his name.



## THE TROGONS

THE Trogons are among the most beautiful birds of the tropics. They are found to some extent in Africa and the East Indies, but chiefly in South and Central America, where there are at least forty different species.

This bird has two toes turned backward and two forward, like the parrot, but he is unlike other birds in having the inner instead of the outer pair of toes turned backward. His bill is short and strong, and in most species the edges are toothed like a saw; a few species have bills with smooth edges.

The American Trogons live in thick forests and make nests in hollow trees. The female lays from two to four eggs and raises several broods in the course of a year. Fruit enters largely into the food of the American Trogon, but the African birds of this family are insect-eaters, and catch their food while on the wing.

Think of a bird only ten or twelve inches long, with a tail nearly four feet in length! That is the case with the Resplendent or Peacock Trogon, which is found in Mexico and Central America. His plumage is a beautiful bronze green above and on his throat, and his breast is scarlet. The feathers on his head form a bristling crest from the beak to the back of the neck, and altogether he is a beautiful and remarkable bird. The females are plainer birds and do not have the long, floating train. In Central America, this bird is called the Quezal, or Quetzal, from an old Aztec word which means "feathers." Guatemala has taken the Quetzal as its national emblem, and you will find pictures of this bird on the postage stamps of that country.

When the Quetzal flies rapidly through the air, with his long train streaming behind him, it is hard to realize that he is a bird. He whistles softly "Whee-oo! Whee-oo!" at times, and gradually raises his note until it is a loud cry. At other times, his cries are harsh and unmusical, like the parrot's. Like other Trogons, the Quetzal makes a nest in a hollow tree. The eggs are bluish green in color.

## COCK-OF-THE-ROCK

ONLY in the northeastern part of South America do we find the singular bird known as Cock-of-the-Rock. He does not live near the coast, but only in dense woods in the interior. Here, in some rocky gorge, he makes a nest in a secluded corner or crevice. The bottom of the nest is made of mud and clay; then some twigs are added and a lining of moss.





RESPLENDENT TROGON.  
 $\frac{1}{8}$  Life-size.





COCK-OF-THE-ROCK.  
6 : Life-size.

Illustrated by J. W. Gifford, 1880.

The female Cock-of-the-Rock is plainly dressed in dull olive-brown plumage; but the male bird has a magnificent coat of orange red. The feathers on his head are very fine and long and stand erect, enveloping his entire head in a sort of feathery helmet, in which his beak can hardly be seen.

The Cock-of-the-Rock is very shy, and is usually solitary in his habits. During the day he hides in dark places in the woods and comes out to look for food only before sunrise or after sunset.

## THE AUKS

SOME of the most remarkable species of the bird family are never seen by most of us—unless it be that we find their stuffed skins in the show case of a museum. To find them in their natural state, we should have to go to desolate regions along the shores of the sea, where they dwell among the rocks and are visited only at long intervals by hunters and sailors.

One of these birds is the Razor-billed Auk. His home is in the bleak regions of the arctic circle, and even in winter he is rarely seen south of the middle states.

He is about eighteen inches in length, with black plumage above and white below. The throat feathers are of a rich brown color. The Auk's bill is flattened vertically and has a slight horny hook at the end. These birds nest on a high cliff near the ocean and return to the same spot year after year. They dwell in communities, and at one of their favorite nesting grounds many thousands may be seen at a time.

The female lays only one egg as a rule, but if the first is taken, lays a second. The Auk's egg is about 3 x 2 inches, dull white, buff, or reddish brown in color, and spotted with gray and brown. This egg, which is quite pointed and does not roll easily, is laid on the bare rock, or perhaps on a little heap of pebbles, and as the Auks nest near each other, thousands of eggs may be found on the rocks in the nesting season, so close together that the surface of the cliff is whitened with them.

The fishermen who live on the coast of Labrador collect the eggs, which are considered a delicacy, and at the same time destroy the birds in order to get the fine white down from their breasts. It is dangerous work, this egg-gathering, for the hunter must clamber about on narrow ledges of cliffs, where a single misstep on the slippery rock may throw him into the sea or upon jagged rocks hundreds of feet below. Sometimes he is lowered to the face of the



cliff by companions above, who support him by a rope passed around his body under the arms. When the egg-hunters appear among them, the Auks take flight in such numbers as to darken the sky. If one is wounded and caught, however, he will defend himself with the terrible blows of his razor-like bill.

The Auk feeds upon fish, and, to get them, swims and dives with the greatest ease. His large feet are webbed and he swims with a powerful stroke. He can also fly rapidly for some distance. When running or walking, he looks very awkward.

The Great Auk was one of the largest of the sea-birds. We say "was," because the species is now extinct, and it is fifty years since one of these great birds has been seen. He was twice as large as the Razor-billed Auk. His plumage was much the same as the latter bird's, but his wings were very short, so that in time he was unable to fly at all, and could not reach a safe place on the cliffs during the nesting season. The eggs that escaped their numerous enemies became fewer and fewer, until there were no more Auks hatched and the old birds died or were killed by hunters.

The Great Auk loved the bleak shores in the southern parts of the north polar seas, and lived on large fish. He could swim and dive well, but could walk only with difficulty and utterly failed in flying. Probably there was a time, thousands of years ago, when the Great Auk's wings were well developed and he could fly as well as the Razor-bill. The Eskimos once hunted this bird, not only for the down and eggs, but for the skin, which was strong and served them in making clothing. Few men now living can say that they have ever seen the Great Auk in his native haunts of the North.

## THE WANDERING ALBATROSS

THE Wandering Albatross is the rover of the seas. His strong pinions carry him great distances over the water, and he often perches to rest on a ship far out in mid-ocean. He is an object of reverence to the sailors, who believe that disaster will overtake anyone who wilfully injures one of these birds. In that weird poem, "The Ancient Mariner," the uncanny personage "of the long, gray beard, and glittering eye" believed that his shipwreck and suffering were a visitation of Divine wrath, incurred for shooting an Albatross.

The Albatross is as large as a goose, and is about eleven feet across the outstretched wings. His plumage is generally a yellowish white, with upper wing feathers of dusky brown, which change to white as the bird grows older.

He makes a nest in an open spot on the shore of an island in the sea. Rough weeds and grass are cemented with mud to form the nest, and a lining of feathers makes it comfortable for the young bird. The nest is built in the form of a cone, with a cup at the top, in which the egg is laid. Year after year the Albatross occupies the same dwelling, adding new material to it each season, so that in time it becomes a lofty structure six or eight feet in height. The female lays a single egg, which is white and has a coarse, rough surface.

The Albatross feeds almost wholly on fish. He is a glutton, and sometimes swallows a fish of four or five pounds weight—so large that when the greater part of the fish has disappeared down the captor's throat, the tail may be seen sticking from the greedy bird's mouth.

The Albatross may be caught on a hook baited with fish, but the natives of the remote islands where they breed knock them over with clubs, after the birds have been feeding and are so dormant that they make no effort to escape. The natives use the bones of the Albatross for making pipes and other small articles. The flesh is rank and unpalatable, but the egg, which is as large as that of the goose, is good for food.

Though after dinner the Albatross is not in a very brilliant frame of mind, when the effects of the enormous meal have passed away, he will defend himself bravely against his enemies. His long bill, which is hooked at the end, is a formidable weapon, and with it he can deal a severe blow. When enraged, he utters a harsh and deafening cry, as a warning to those disturbing his peace.

During the brooding season, the male takes good care of his mate, as she sits on the nest, and keeps her well supplied with food. The female is so tame, or so dull, that the egg on which she sits may be taken from her, without arousing any resistance on her part. Other birds hover about the breeding-places of the Albatross, intent upon stealing the egg, if the female leaves the nest; and the nest itself is appropriated by the penguin, as soon as the young Albatross has flown.

## THE PELICANS

THE Pelicans are uncouth birds, yet their peculiar habits make them objects of study. They are the largest of the web-footed waterfowls, some of them being over five feet in length. Their plumage is generally white, with a tinge of yellow or orange. The remarkable bill, fifteen or twenty inches long, with a strong sac or



pouch of skin attached to the lower side, is one of their chief characteristics. This pouch is large enough to hold two or three quarts of water, and it was formerly believed that the Pelican carried water in his pouch to birds and animals in the desert.

Many other fabulous tales were circulated by travelers, before men began to study closely the habits of birds and beasts, and to correct the false impressions given by imaginative tourists. The pouch is simply a fish basket or dip-net, which the Pelican uses to scoop up fish from the swarming schools of fry. Or if he is catching larger fish, he stows them in his pouch one by one, until he has enough to carry home for his family.

Most Pelicans consider ten or twelve pounds of fish an ordinary meal. After such a hearty repast, they are not very energetic, but remain quiet for several hours, often dozing, while the process of digestion is going on.

The White Pelican of Europe builds a nest of grass, etc., loosely put together, at the top of a heap of sand or gravel, and for a nesting place he prefers the beach of an island, or some spot not easily reached by enemies. Usually ten or a dozen birds live together in a community. The eggs, which are two in number, are white, with a rough surface.

The American White Pelican is found in the Mississippi Valley, along the Gulf coast, sometimes on the Great Lakes, and occasionally, but not regularly, on the seacoast.

The American White Pelican thrives in captivity, and, if plentifully supplied with proper food, will live for many years, for he is naturally a long-lived bird, and some specimens have been known to reach the age of seventy-five years. At the National Zoölogical Park, near Washington, D. C., is a captive Pelican, which affords great amusement to visitors, especially the young folks. He has quite a large yard to himself and prances from one end of it to the other, flapping his wings and hopping with ludicrous steps, while he utters loud, hoarse cries, something like the "honk" of a goose, though much louder.

## THE GULLS

THE Gulls follow the same calling on the sea that the buzzards have chosen on the land, so that neither trespasses upon the feeding-places of the other. Like the vultures, they win our gratitude by performing services that would be distasteful to many. Although there is nothing poetical suggested in their diet, the Gulls are very pretty birds, and graceful in their motions.

Gulls are found in all parts of the world where there are large bodies of water. Their staple food is fish, which they catch at the surface of the water, but, in addition, they eat all kinds of animal refuse, which they find floating on the waves or cast up on the shore. They follow outgoing steamers, sometimes for fifty or a hundred miles from shore, to pick up the scraps of food which are thrown overboard. On the beach, they feed on decaying animals and other refuse which has drifted in with the tide, and remove it before it becomes a nuisance. They seem to be constantly on the wing, flying low and keeping a sharp watch for anything eatable, for they have enormous appetites.

These birds have webbed feet and are perfectly at home in the water. Wet and cold have no terrors for them; even in the arctic regions they are found in abundance.

Some Gulls nest in a hollow in the sand, others in trees or on rocky cliffs. They are found not only on the seacoast, but on the shores of large lakes and rivers.

The Herring Gull is the commonest of these birds. His head, tail and under parts are white, and his wings and back are gray. He has a touch of black on his outer wing feathers, and on his yellow bill is a splash of red. His length is from twenty to twenty-five inches. In winter his head and neck are streaked with gray. When he makes a nest on the beach or on a rock, it is a loosely-built structure of grass or moss; sometimes he builds it on a low tree and then it is more strongly made, of sticks, seaweed and feathers.

The eggs, which are as large as a hen's egg, are buff, tinted with green and marked with brown and lilac. In winter the Herring Gull goes to the coasts of the southern states and to the shores of the inland lakes. He is a shy bird, but quarrelsome, and attacks smaller birds or bravely defends his own young. He is a noisy fellow, and screams harshly when disturbed or excited. As we see him flying steadily over the blue water, his white plumage glistening in the sun, he is a beautiful creature. It is interesting to see him descend swiftly to the water, seize a fish, and rise with it into the air. He flies on and on and seems never to grow weary.

The Ring-billed Gull is similar in plumage to the Herring Gull, but has a greenish-yellow bill that has a band of black near the end. He is also smaller. This Gull is common in the interior of the continent, where he seeks bodies of water like Great Salt Lake, but is not so plentiful on the fresh-water lakes. He feeds on fish and refuse, like other Gulls, but also eats grasshoppers and other insects.

The great Burgomaster Gull is the giant of his species. He is about thirty inches in length, with large webbed feet of a bright pink



color, which form a striking contrast to his white plumage. This Gull is an arctic bird and is rarely seen as far south as New England. He is the tyrant of the polar regions, as the pirate eagle is the monarch in countries farther south. He robs the other birds of their fish, and, when very hungry, devours the birds themselves. His loud, harsh cry is extremely disagreeable, and the smaller birds learn to regard the Burgomaster Gull as a veritable ogre.

Bonaparte's Gull is one of the most beautiful of the sea-birds. He is a small bird, being only twelve to fourteen inches long. He seems to think that entering the domestic sphere is equivalent to taking the black veil, and during the nesting season wears a gray hood, which covers his face and neck. In the winter, he discards this for a simple dusky spot on each side of the head. His nest, which is more pretentious than that of most of the Gulls, is made of twigs lined with feathers and moss, and is found in trees and bushes rather than in the sand.

Bonaparte's Gull winters in the South, and brings up his family there. He is rather more fastidious than other Gulls in his diet and does not eat carrion. Insects and fish comprise his bill of fare, and his flesh is good for food. This is not true of the Gulls that feed on refuse and decayed flesh, which imparts a rank, fishy flavor to the flesh.

The Black-headed Gull, or Laughing Gull, as it is often called, is found not only in America, but also on the warmer coasts of Europe. This bird is larger than Bonaparte's Gull. His plumage is deep gray above, with slaty-brown feathers on the head and neck, and the white feathers underneath are tinged with pink. He feeds on insects, worms and crabs, picks up refuse on the shore and catches fish, but spends less time on the ocean than some of the other species. He has a note that sounds like a broad "Ha, ha, haw!" and for this reason is nicknamed "Laughing Gull."

The Terns belong to the same family as the Gulls; for they are long-winged swimming birds, and as they make similar nests, eat similar food and have similar plumage, they are often mistaken for Gulls.

The Common Tern has gray plumage above, white underneath, and black feathers on the crown of his head and the nape of his neck. His tail is long and deeply forked, and distinguishes him at once from the Gulls. His body, too, is much more slender, and his bill is longer. He is a light and active bird, and from his graceful flight is often called the Sea Swallow.

The Common Tern scoops a hollow in the sand, and sometimes adds a little grass or seaweed, to serve for a nest. In this the eggs are laid and left part of the time for the sun to hatch, for the mother











bird sits on them only at night or in wet weather. When the young Terns appear, the parent birds take good care of them, bring them fish and insects for food, and finally teach them to provide for themselves.

The Common Tern is a sea-bird, but the Black Tern is found chiefly around the lakes and on the rivers of the interior. His tail is shorter than that of the Common Tern and his plumage is gray and black. In winter, however, he puts on a coat of white feathers. His nest is sometimes a hollow in the mud of a marsh, lined with weeds and grass; but at other times he builds it on a floating platform of growing water-plants, and makes a substantial nest of reeds well woven together. Those who have closely watched the Black Tern say that he seems to eat little or no fish, but feeds chiefly on insects which swarm about the water.

There are many other species of Gulls and Terns. They are the most numerous of the sea-birds, and on bright days are always to be seen near large bodies of water. They move north or south, according to the season, and always travel in flocks. They do not allow their domestic duties to interrupt their social pleasures, for instead of going into retirement to rear their young, they often nest on a rocky headland in such numbers that thousands of eggs are to be found in a very small area. It should be remembered that these are useful birds and do no harm. Some species have been cruelly persecuted by the hunters of feathers who supply the milliners, but as many species breed only in the far North, where they are not easily reached, the various species are not likely to be entirely destroyed.

## THE LOON

THE Loon, or great Northern Diver, is one of the most expert of the diving birds, and is well known in all the cold and temperate countries of the North, in Europe as well as in America, wherever there are lakes with sparsely populated shores.

He is larger than a duck and has a beautiful coat. On the back it is black, with curving rows of white spots. The head and neck are also black, with beautiful shades of green and purple intermingling, and around his throat is a wide collar of white stripes. The Loon has a strong bill, not flattened like that of the duck, but tapering to a point. With this bill he can defend himself against enemies and spear the fish, which he catches below the surface of the water.

This bird's wild and dismal scream sounds like the laughter of an insane person, and doubtless you have heard the expression, "as crazy



as a Loon." As a diver, this bird is justly famous. He swims swiftly on the surface of the water, until his keen eye detects a fish in the depths of the lake. Then down he dives, as straight as an arrow, and, seizing his prey, returns with it to the surface. He dives to great depths in pursuit of his prey, and it is said that Loons have been caught seventy feet below the surface, on hooks baited for fish.

He dives so quickly that he is often able to dodge a gunshot when he sees the flash of the gun, and is cunning enough to swim under the water for a considerable distance, before reappearing on the surface, thus puzzling the hunters, who are watching to sight him as he rises. He may turn after diving, and swim under the boat in which the hunter sits, and, after some lapse of time, the eager sportsman turns to see that the Loon has been swimming away from him while his back was turned.

The Loon is at all times shy and watchful. He never allows man to approach him without instantly seeking escape by flying or diving. In the air, he is an easier mark for the gunner, and as he knows this well, he trusts to the water when he can reach it. When he has made his escape, he is often heard to utter his weird laugh, as much as to say, "You have been outwitted by a bird, after all."

An island in a lake, with wide reaches of water about it, is a favorite nesting-place for the Loon, or he may build on the margin of the mainland, where the marsh-grass and reeds grow rank and tall. These serve to hide the nest, which is placed on the ground and rudely made of grass and reeds. The eggs are as large as those of the goose, of a dusky olive color and marked with irregular patches of dark brown. As a rule, only two eggs are found in the nest.

The Loon is not a model father, for he shifts upon his mate all the responsibility of bringing up his children. As soon as the young are hatched, he deserts the nest to join the other males that are assembling in flocks, in bays and creeks near the ocean. But the mother bird remains to care for her young until they are able to fly and look out for themselves. Then the whole family flies off to the sea.

When the Loons feel the nip of frost in the air, they know the lakes and streams will soon be covered with ice; so they move southward by easy stages, in order to be near open water.

The Black-throated Loon is usually found only in the far North. In this country, he is seen about Hudson Bay, and in Europe he is abundant in Norway, Sweden and Siberia. The Eskimos and Norwegians use his skin for making garments. It answers admirably, as it is thick and tough and sheds water perfectly.

The Red-throated Loon is also a bird of the cold North, but in winter has been seen as far south as the middle states. His coat is

black, with fewer spots of white than that of the common Loon, and the head and neck are gray, with a patch of chestnut on the throat.

Besides fish, these birds eat frogs, insects, and the seeds of water plants. Their flesh is eaten by the people of the far north, but to the taste of many, it is too fishy to be pleasing, and is tougher than our duck and turkey.

## THE COMMON PUFFIN

THE Puffin is one of the sea-birds that prefer the cold, bleak regions of the north to warmer climates. He is sometimes called the Sea Parrot, from the resemblance of his head and bill to those of the real parrot.

There are several species of these birds. One is the Tufted Puffin, which has a coat of black and dusky brown, with a tuft or crest of buff or yellow, and a large patch of white on the side of his head. His enormous bill, which ends in a sharp point, is vermilion red and yellowish green. This bird is found on the shores of the North Pacific Ocean. The Common Puffin is found on the shores of the North Atlantic. It has a dark collar and a white breast, but no crest.

Puffins do not make nests as do most other birds, but lay their eggs on the rocks, or, more commonly, where the soil permits, in burrows, which they dig in the earth to a depth of three or four feet. Where there is a rabbit-warren near the sea, the Puffin takes possession of a rabbit's burrow and with his strong, sharp bill puts the four-footed owner to flight.

The single egg laid by the Common Puffin is white, marked with brown and purple, and is shaped like a pear. When the young birds are hatched, the parent Puffins take good care of them, bringing them an ample supply of fish to eat, and defending them against the attacks of other birds or of hunters. They will not desert the little ones, but remain to fight any intruder, often inflicting serious bites on the hands of bird-hunters who try to take the little Puffins from their burrows.

The Puffin eats fish, crabs, shrimps, and some kinds of seaweed. He is a good swimmer, but his wings are not powerful and he flies laboriously. On the land, his gait is ungraceful, for he rests the weight of his body on the whole length of the leg and foot, and waddles along with an awkward shuffle.

The flesh of the Puffin, like that of other birds which eat little besides fish, is rank and oily; nevertheless, it is spiced and potted, and sold in the markets of Europe; some people like it very much.

Puffins are found in great numbers among the islands off the coast of England and Wales, and in America as far south as Nova Scotia.



## THE CRANES

THE Whooping Crane, also called the Great White Crane, is one of the largest of American birds. He is found in the West, beyond the Mississippi River, and ranges northward from Texas. Sometimes one or two birds of this species are seen in Illinois or in the swamps of the southeast, but never in the northeastern states.

This bird is between four and five feet in length. His plumage is white, with black outer wing feathers. His head is nearly naked, and the bright orange-colored skin is relieved only by black feathers as fine as hair. From the inner part of the wing grow long plumes, which are very graceful and attractive. The Crane has a long, stout, pointed bill, of a greenish yellow color.

This Crane is usually found near marshes and swamps, for he is one of the long-legged birds intended by nature to find their food while wading. He does not depend so largely upon fish for his food as the herons do, but seeks for frogs, snakes, mud-worms, grasshoppers, fruit and grains, and often prowls about the fields looking for mice and moles.

His nest is built of rank grass, on a mound of dry earth near the margin of a swamp. The two or three eggs are bluish gray, marked with bright brown, and have a rough surface.

Except during the nesting season, Whooping Cranes live in communities, and when they migrate from one part of the country to another, they fly in great flocks. When migrating they give utterance almost continuously to their peculiar cry, which is so loud that it sounds like a whoop or yell and can be heard at a distance.

The Crane is a shy bird and avoids the vicinity of man, but, if attacked and wounded, is able to defend himself with his sharp, pointed bill. The Sand-hill Crane is sometimes mistaken for the Great Blue Heron; he is about the same size, four feet in length, and has long, slender legs. His plumage is a bluish gray, with touches of dull yellow; the wings are a grayish brown, and the long bill and legs are dark-colored. He has graceful plumes, like those of the Whooping Crane. This bird makes his nest on the marshy shore of a pond or river on the prairie. Sometimes the nest is nothing more than a hollow scooped in the earth, but occasionally the hollow is lined with tufts of dry grass. The eggs, two or three in number, are of a drab-brown color, with brown blotches, and have a rough surface. The food of the Sand-hill Crane is insects and frogs, fruit, grain and grass, but he is like the ostrich in snapping up stones, nails and other hard substances, to assist in digestion.

## THE HERONS

THE Herons are wading birds, provided with unusually long legs, which enable them to wade into deep water to watch for the fish, which form the chief part of their food. They have not only long legs, but long necks and bills, which they thrust under water in order to seize their prey.

The Great Blue Heron, sometimes called the Blue Crane, breeds from Hudson Bay to South America, and is well known throughout the continent, though he is abundant in few places. His height is between four and five feet. His color is a slaty blue above, and black underneath, with brown leg-feathers. He has a black crest, from which wave two long, slender feathers, the crown of the head being white. From the breast hang long plumes of gray. His sharp, stout bill, longer than his head, is yellow, and his legs and feet are nearly black. This description gives but a faint idea of the stately appearance of this great bird, as he stands motionless on the edge of a swamp or in the water.

When he rises in the air, with a harsh "squawk," his legs dangling beneath him and his great wings extended, he is less graceful, yet his flight is easy and he soars high. The Heron is a splendid bird, and it is a pity that he should ever be shot, for he does no harm whatever to man. He is timid, in fact, and asks only to be let alone. Herons usually live in communities, and make their nests in lofty trees in a swamp or a deep wood. These places are called heronries, and in some places, where there are desolate swamps of great extent, the heronries are occupied by scores of the great birds.

In repose, the Heron looks very sober and majestic. But just before the mating season he relaxes somewhat, and the Herons all assemble in one spot, where the males indulge in a curious performance. Standing in a circle, they allow one of their number to show off inside the ring. He prances around and flaps his wings in a manner to attract the females, who give vent to their approval in hoarse murmurs, which have been compared to the croaking of a bullfrog. His rivals freely criticize his performance in low, rasping notes. When one bird has acquitted himself as best he may, he returns to the circle to give place to another performer, who does his part for the amusement of the company.

The nest is coarsely built of sticks and, with a lining of fresh twigs each season, is used year after year. The female lays three or four large eggs, of a greenish blue color.

When the Heron is hungry, he wades out into the water and stands motionless. When the fish come near, he bends his long neck and



seizes his prey in his powerful bill with a stroke as true as that of the fish-hawk. If the fish is a large one, the Heron beats it to death, and then swallows it, head first. On the land, the Heron catches moles, mice, and crawfish, and snaps up grasshoppers and other large insects. Herons have been known to eat the young of other birds. All birds and animals are more or less inclined to be inactive and stupid when they have eaten a large amount of food, and at such times they are more easily captured. The Heron, however, if in danger of capture when he has recently eaten, often disgorges the food he has swallowed, so that he may not be hampered in his flight by the weight of the undigested food. This bird often migrates to great distances.

The Snowy Heron, or little White Egret, is much smaller than the Great Blue Heron. He is only about two feet in height. His plumage is snowy white. He has a long crest, with fine plumes, like hairs, on the back of his neck, and plumes on the breast and back. Those on the back reach beyond his tail and curve backward at the tip. These delicate, airy plumes have made the Egret an object of prey to hunters.

They are in great demand for use in millinery, and in order to obtain them, the birds have been slaughtered by thousands, so that in some parts of the country the Snowy Heron is no longer seen. The most cruel feature of this slaughter is that these plumes appear only during the nesting season, and to get them, the birds must be taken when the young Herons are still in the nest and require the care of the parent birds. When the parent birds are killed, the young Herons die for want of food, and a few years hence these beautiful birds are not likely to be seen at all. The Snowy Heron dwells in swamps and builds a nest on a cedar or willow tree. Fish, frogs, crabs, and worms are his chief items of food, and he also eats the seeds of the pond lily and other water plants.

The Black-crowned Night Heron is sometimes called the Qua Bird, from its hollow note, which sounds like "Qua! Qua!" The top of his head and his back are greenish black; the wings and the sides of the neck are bluish gray; and the throat and sides of the bird are white. The under feathers are white, with a tinge of pale buff. He has no plumes like the Egret, but two very long, slender white feathers extend from the back of the head and fall gracefully over his back. His eye is red, his stout bill black, and his legs yellow. From this description, it is readily seen that he is a beautiful bird. This Heron ranges south from Nova Scotia, and lives in swamps and marshes, as other Herons do. He occupies the heronries year after year, and in his habits of feeding and nesting and in his fear of man, resembles the other birds of this family.





From col. Chi. Acad. Sciences.

GREAT BLUE HERON.  
1/2 Life-size.

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FROM COL. CHI. ACAD. SCIENCES.

ROSEATE SPOONBILL.  
 $\frac{1}{3}$  Life-size.

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The most common of these long-legged wading birds is the little Green Heron. His crown and crest are of a rich green color; the rest of his head and the neck are chestnut; the dark slaty gray of his coat is tinted with green, and the tail and wings are dark green. He is only eighteen or nineteen inches in height, but no less beautiful because of his size. His habits are similar to those of the larger Herons, though he is a more venturesome bird, and is sometimes seen near small ponds in gardens and large parks, where he seeks to allay his hunger with frogs and fish.

The American Bittern, or Stake Driver, belongs to the Heron family, and gets his nickname from the explosive, hollow, booming noise he makes. It sounds like the noise made by pounding on a post or stake, and may be heard a long way off. The Bittern's plumage is mostly spotted brown and black; he has no plumes. His nest is made of grass, rudely put together, and is always found on the ground, usually near a swamp or marsh. The flesh of the Bittern is said to be excellent for food.

## THE AMERICAN RED FLAMINGO

ONE of the tallest of our wading birds is the Flamingo. This bird is a native of Florida and the Gulf coast, and southerly, and is nearly related to the Old World Flamingo.

The Flamingo is five feet in height and has very long, slender legs and a long neck. His plumage is bright scarlet, with black on the wing feathers. He has a thick, stout bill, almost as wide as his slender head. The bill is yellow at the base and black at the tip. These birds live in colonies, like the herons, but do not build nests in trees, as herons do. Instead, the Flamingo scoops a hole in the mud or builds a cone of mud, and in this nest the eggs are laid. The eggs are long and white, with a rough, chalky surface.

Fish, frogs, and water insects, are the favorite food of these birds. They wade into deep water and stamp on the mud at the bottom to stir up the fish. Then they plunge their long necks under water and with their sharp bills seize their prey. One of a troop of Flamingoes remains on the bank as a sentinel, to watch for enemies, and if he gives the alarm, the others immediately rise in the air and fly with him to a place of safety. When sitting on the nest, the bird curves his long neck backward and hides his head among the feathers on his back.



## ROSEATE SPOONBILL

THE Red Spoonbill is one of our largest wading-birds, though not as tall as the Flamingo. His height is usually about two and a half feet. He has a long, wide, flat bill, which rounds out at the end, like the bowl of a spoon. His head is bare of feathers. The plumage on his neck and back is white, underneath it is a lovely rose color, and the plumes of his wings and tail are deep carmine. On his neck is a patch of yellow. It is not hard to think of him as a bird of beautiful colors.

Like many other waders, the Spoonbills live in colonies in swamps where they build rude nests of sticks in the low trees. The nest is a simple collection of sticks, put together so as to make a platform, not far from the ground. The eggs are three in number, dull white, blotched with brown.

When the Spoonbill is hungry he thrusts his long bill, partly open, into the soft mud and moves it to and fro, capturing small fishes, crabs, and water-insects.

The Red Spoonbill is found in the tropical part of America, and was formerly a common bird in Florida, but hunters have destroyed so many of these birds, in order to get their plumes for the milliners, that they are becoming rare. They are still found, though rarely, in small flocks in the Gulf states and in the Valley of the Mississippi River. A nearly-related Spoonbill is also found in Europe. This species lives in cooler regions than its American cousin, and its plumage is white.

## THE STORKS

IN HOLLAND and Germany the Common White Stork is one of the most familiar features of the landscape. He is a half-domesticated bird, building his nest on the house-top or on the roof of a church. The quaint, red-tiled cottages, with chimneys surmounted by Storks, each on one leg, make one feel that the centuries have lost track of the sleepy villages, whose picturesque repose has never been disturbed by the progressive spirit of the time.

The little Dutch boys and girls, as well as those of Germany, are taught a pretty fiction regarding this bird. They believe that the Stork has it in his power to bring them little brothers and sisters from some fabled pond, where tiny human children lie dreaming until their patron bird provides them with a home. Whenever a Stork lights on a chimney, the little ones of that household are on tiptoe of expectancy, for to them it is a sure sign that a child is to be brought to that family.

The Stork is a large wading-bird of the heron order. He is common to Europe, but does not visit the United States. In South America, however, a species of Stork is found. In Holland, Storks are very common, and because they act as scavengers, just as the turkey buzzards do in this country, they are protected by law, and no Dutch boy would venture to hurt one of them.

The Stork is a migratory bird, and spends the winter in Africa, returning to the north of Europe in the spring. He is found in marshy regions where there is sufficient food, such as fish, reptiles, insects, birds, and mice. He builds a large nest of sticks, in which the female lays three or four buff-white eggs. Both the parent Storks take good care of their young and the young birds are said to return the affection bestowed upon them. Because of their kind treatment of each other, Storks were regarded by the people of ancient times as symbols of piety, filial love, and gratitude.

The species of Stork best known, because most common, has white plumage, with some black on the wings. His bill and feet are red. He has very long legs and stands about three feet high.

The Stork has no voice and the only noise he can make, to express pleasure or excitement, is made by snapping his jaws together. When a flock of Storks has assembled for the purpose of migrating to the South, the general clashing of bills is a noisy proceeding.

When the Stork sleeps, he rests on one leg, drawing the other up under him, folds his neck and rests his head on his shoulder. He walks slowly and gracefully, and flies very easily, high in air, with his legs extended behind him.

The Black Stork is found in nearly the same countries as his white relative, but is not so fond of man, building his nest in lofty trees, where he is likely to be safe from interference.

In India and Africa, there is a species of Stork called the Adjutant, because he is often seen about camps and barracks where he goes to look for offal. This great bird is about six feet in height. From his neck hangs a remarkable pouch, which fills with air during flight and helps to sustain his weight while on the wing. Marabou is another name given to this Stork, perhaps you have seen the "marabou feathers" used on ladies' hats. They are the plumes of the Adjutant Bird.

Storks are useful creatures, for they remove decaying flesh-matter which might breed pestilence, besides eating snakes and troublesome insects. They are harmless and become very tame when brought into close association with man. In some of the European cities they may be seen stalking solemnly about the streets in search of refuse, confident that no one will do them harm. The flesh of the Stork is rank and not fit for food.



## THE SECRETARY-BIRD

THE Secretary-bird is found only in Africa, and even there he is not a common bird in the settled parts of the country. He stands about four feet high. He has long legs, like the wading-birds, but they are feathered down to the knee, as in the falcons, while those of the wading-birds are not. His bill is short and curved and has a hook at the end. He is, in fact, a bird of prey. His plumage is bluish gray, with white on the chest and throat and black on the wings and tail.

On the back of his head is a crest of black or gray plumes, which stand out distinct from each other and readily suggest the appearance of a bunch of quill-pens stuck behind a clerk's ear. It was this resemblance that gave the bird the name "Secretary." He is also called the "Snake-eater," from the fact that he attacks and devours snakes. He does not pounce on a snake from the air, but walks toward it, extending one wing to receive the snake's attack, and holds himself ready for a blow with his foot. When he knocks the snake down, he tramples it and, as soon as it is lifeless, swallows it.

So quick and cautious is this bird in his movements, that he can defeat any snake in a contest of this sort, and he does not hesitate to attack the most venomous of reptiles. Frogs, toads, and lizards, are the Secretary-bird's favorite food, but he also eats rats and other small animals. In some parts of South America these birds are tamed by the farmers, who keep them about the poultry yards to destroy rats and snakes, which steal young chickens and eggs; and the Secretary-bird makes an excellent police-officer, for the rats and snakes soon disappear from his neighborhood. These birds always have good appetites, however, and unless well supplied with food, they may eat a few chickens themselves. They often add birds and insects to their diet of reptiles.

The Secretary-bird does not often fly, unless hard pressed by enemies, and even then he usually trusts to his long legs, with which he can outrun a pony. Usually he is seen stalking about the country with a stately stride, accompanied only by his mate, for these birds live in pairs and never in flocks. He walks very fast and keeps a keen lookout for prey as he goes along.

The nest of this bird is a bulky structure, made of sticks and lined with feathers and wool. It is placed at the top of the highest tree in the neighborhood, or if there are no trees, on a bush. The female lays two white eggs, spotted with brown at the larger end. The young birds remain in the nest a long time—much longer than any of the birds with which we are familiar in this country. Sometimes

four months go by before the young Secretaries are able to use their slender legs, to go in search of food. Meanwhile, the parent birds keep them well supplied with small snakes, frogs, and insects.

The Secretary-bird is regarded with favor by the African farmers, because of his destruction of reptiles and vermin, and is protected by law from hunters. Naturally he is very shy, but once tamed, he makes himself thoroughly at home about the house, and comes and goes as independently as the cat or dog.

## THE IBISES

THE Ibises form a family of large birds related to the storks and herons. They have long bills, usually arched, unlike the straight bill of the stork, a long neck and moderately long legs.

The most famous member of this family of birds is the Sacred Ibis of Egypt. This bird is about two and a half feet long, with white plumage, except for the black primaries and tail plumes. His head and neck are black, and without feathers. He has a very long, curving beak, and stout legs. The modern Egyptians call this bird "Father John," and, as his flesh is excellent food, they snare and shoot the birds in great numbers. But in ancient Egypt, a person who killed an Ibis was at once put to death.

Ibises dwell in flocks and build their nests on tall trees, like the mimosa—sometimes twenty or more nests on a single tree. The nest is made of coarse twigs, and is lined with grass and feathers. The eggs are a pale green, and about the size of a duck's egg.

The bill of fare of the Ibis is much like that of the stork,—fish, reptiles, insects, and offal. He drives his long bill into the mud, in search of worms and small shellfish, and eats frogs and lizards. The ancient Egyptians believed that they destroyed snakes, but modern naturalists say this is not true, except in rare instances.

The Ibis was venerated by the Egyptians, because he appeared at the time of the rise of the Nile, which brought prosperity to the country by flooding the land and making it possible to raise crops. Of course the Ibis came at that season because, with the rise of the river, he found more food in the shape of fish and mollusks; but the priests taught the people to believe that the contrary was true,—that is, that the river rose because the Ibis had come. It was thought that the Ibis drank only the purest water, and pools where the bird was seen to drink were reserved for the use of the priests. The Egyptians believed that the Ibis loved Egypt so much that if taken to foreign countries he would die of grief.



Flocks of Ibises were kept in the sacred temple and the birds were worshiped as the most holy of all animals. When they died, their bodies were embalmed with as much care as were those of persons, and thousands of Ibis mummies have been found in Egypt, wrapped in fine linen or preserved in stone jars. Representations of the Ibis were carved on the monuments and obelisks, and in every way the highest honors that could be thought of were paid to this bird.

Several species of the Ibis are found in America, but none appears farther north than the southern United States.

The Scarlet Ibis is a beautiful bird. His entire plumage is a rich scarlet color, except the tips of the longest wing feathers, which are black. This bird is found only in the warm regions of the tropics, and is accidental as far north as the Gulf states.

The White Ibis ranges farther north, and has been seen in New Jersey and in Illinois, but only rarely does it go northward beyond North Carolina. The plumage is pure white, except for black tips to the wing feathers. The long, curving bill is red. This bird is about twenty-five inches long, and has a bill seven inches long. White Ibises are found in colonies near the seashore or on the shore of a pond, sometimes a hundred miles or more from the sea. The nest is woven of reeds and twigs and lined with leaves. It is placed among the rushes or on a bush or low tree. The eggs are white, with a faint blue tinge, and marked with brown. The Ibis rests and sleeps standing on one leg, with his neck thrown back and the bill resting on his breast. Crawfish, fry, water insects, and small mollusks, furnish him with food.

The Wood Ibis, or Wood Stork, is found in all the southern states, where he was once a common bird, and has been known to go as far north as Ohio and Indiana. He never lingers in cold regions, however, and in winter goes to the tropics. The Wood Ibis is gregarious at times, like other birds of this family, but at other times is solitary. It breeds in colonies, and makes its nests in the tops of lofty trees, usually in a dense cypress swamp. The nest is made of twigs, loosely put together and lined with the soft moss that hangs from the trees. Two or three eggs are laid, dull white in color and having a rough, chalky surface.

The general color of the Wood Ibis is white. The tail and outer wing feathers are black. The head and upper part of the neck are without feathers, and the skin is a dusky color. The Wood Ibis is larger than other species, and measures forty inches or more in length. With his long bill, curving slightly downward, he probes in the mud for shellfish and worms, or, wading into the water, watches for frogs, fish, insects, and like prey.





FROM COL. F. KÄMPFER.

SCARLET IBIS.  
 $\frac{1}{3}$  Life-size.

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From col. Chi. Acad. Sciences.

SOUTH AMERICAN RHEA.

$\frac{1}{8}$  Life-size.

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He stirs up the fish by scratching the bottom of the river or lake with his feet, and as they dart away, scoops them up in his long and powerful bill. He occasionally scoops out the meat from the shell of a turtle, and even a young alligator may be included in his prey. When his hunger is satisfied, he flies to the top of some tall tree, rests his great bill on his breast, and dozes for hours at a time. When his hunger returns, he goes fishing again.

## THE OSTRICH

THE Ostrich is the largest of all birds. When full-grown, he reaches a height of eight or nine feet, and weighs from three hundred to four hundred pounds. His long neck and his general appearance suggest the camel, and he is sometimes called the camel-bird, not only on that account but because he lives in the desert and, like the camel, eats almost anything that offers for food. The true Ostrich is found in Africa, but in Australia and the East Indies are found other Ostrich-like birds, namely the Emu and the Cassowary.

The feathers of the male Ostrich are a glossy black, except for the plumes of the wings and the tail, which are snowy white. It is these beautiful curling plumes which ladies admire so much; and for these the Ostrich is still hunted wherever he is found wild, and is now raised on "Ostrich farms," whose owners find the enterprise highly profitable. It takes sixty or seventy Ostrich plumes to weigh a pound, so light and delicate are these beautiful feathers.

No one could accuse this great bird of having a dainty appetite. He picks up a living even in the sandy wastes of the desert, and though he takes vegetable food when he finds it, he swallows stones, keys, knives, broken glass and crockery, and many other things which would seem hard to digest. Any bright-colored object catches his eye at once, and his only idea of showing that it pleases him is to swallow it.

It does not seem possible that any bird can run away from a horse, but that is what the Ostrich really does. When he is feeding, his steps are short, measuring only two feet, but when he starts to run, his long legs shoot out in earnest and he covers nearly twenty feet at a single stride. He can run for a long way, too, though he is a stupid bird, and will rarely alter his course after he is well under way, to choose a safer one. He is said to be so stupid that when run down he hides his head in the sand, and, because he, himself, cannot see, supposes that he cannot be seen.

The Ostrich is very shy, and has sharp eyesight, as well as a keen scent, so that he usually detects an enemy in time to get a



good start in a race. When cornered he fights savagely, depending on his legs for weapons, and with these he can strike a terrific blow.

Owing to his shyness and the speed at which he can move, the Ostrich is not an easy prey, and the African native sometimes conceals himself in an Ostrich skin and walks among the birds, shooting them with poisoned arrows before they suspect that the Ostrich skin contains a man instead of a bird. To protect their young, Ostriches feign lameness, as the quails and partridges do, in order to lead the hunter away from the nest.

This great bird makes a very rude nest. It is simply a hole scooped in the sand, five or six feet across and a foot and a half deep. In this hole the eggs are laid, and sometimes as many as fifty are found in one nest, laid by several birds. The eggs are placed on end in the nest so as to occupy less room, for they are very large. A single Ostrich egg is as heavy and contains as much matter as two dozen hen's eggs. The shell is thick and rough, and is used by the natives as a cup. The skin of this great bird may be tanned and is so tough that it makes excellent leather. The cry of the Ostrich is a hoarse, gruff chuckle, or a deep roar.

The South American Ostriches, or Rheas, are much like their African cousins in habits and in appearance, except that they are much smaller and grayer. It is said that the male Rhea does the greater part of the hatching, sitting patiently upon the eggs for many hours at a time. The natives hunt these birds with the bolas, a weapon of their own, which consists of three thongs of leather that have at one end of each a ball of lead or iron. They are joined together at the other end. The natives throw the bolas with great skill, and it winds about the neck, body, and legs, of an Ostrich so as to cripple him and throw him to the ground, when he is easily captured. There are three species of Rhea, two large and one small.

Full-grown wild Ostriches are not easily tamed, but the young birds, which, when hatched, are about the size of pullets, may be brought up in captivity to be so tame that they will eat from the hand, or permit a very light man to ride on their backs, as he would on horseback.

## BIRD ROCKS

IF YOU will look on your map you will see in the Gulf of St. Lawrence a group of islands known as the Magdalen Islands. At the extreme north of the group, a little black speck is marked "Bird Rocks." The only one of these of any considerable size is a great, solid red sandstone, rising one hundred and sixty feet above

the water and having an upper surface of about six acres in extent. The steep sides of this rock are broken into ledges or shelves that make resting places for the sea-birds and their nests. Almost everywhere around the island the walls are so nearly perpendicular that there is no place where they can be sealed by ordinary means of climbing.

The waters near the Bird Rocks are so shallow and the bottom so rocky that vessels cannot approach the island with safety. The English government maintains a lighthouse on the top of the rock, and the keeper and his family are the only people living on the island. Once a year, in October, the ships bring them their year's supply of food and other necessities, and the only mail they receive during the year. The government vessels approach the island at the most favorable place, and a very long-armed windlass conveys the supplies from the ship to the top of the rock. It is sometimes ten days or two weeks before the vessel can get close enough to make this landing.

The only vegetation on the island is a little grass, that grows, by encouragement, on the top, and the seaweed on the rocks. Only about seven people besides officials, a few fishermen, and possibly some castaways, have landed on the rock, and two of this number were women.

There is no beach, and only at certain favorable times in July can a landing be made. The traveler wishing to reach the island at this season must leave the large vessel about a mile from the rock, and be taken in a dory to a narrow ledge at one side. Even then it is necessary for a boatman to get into the water where it is still several feet deep, and pull the boat to the shore.

A large crate or basket is let down from the top of the rock by means of a rope attached to the beam of the windlass, and in this the passengers are drawn to the top, as in an elevator, swinging out beyond the crags.

Lest this elevator might at some time fail and leave the occupants of the island prisoners, the lighthouse keeper has provided another means of descent. A succession of ladders, one below another, is bolted to the rocks, and to the bottom of one of these another ladder, secured by a rope, swings down to the water.

The sandstone which forms the island crumbles easily, and is being rapidly washed away by the action of the waves. One who climbs about the rocks must be careful not to depend too much upon holding to the ledges for support, as they may break, under even so slight a strain, and let the climber down.

In this bird's fairyland, there are hundreds of thousands of sea-birds, far out of the reach of hunters. The bird-lover, however, who



is willing to endure the discomfort, is permitted by the keeper to go down the ladder to examine the great shelves of birds and nests. Another plan is sometimes adopted by one who is willing to take greater risks in order to visit other sides of the wall. A rope is attached to his body and he is lowered over the crags to places that can be visited by human beings in no other way.

Of the birds that summer in this quiet retreat, the Gannet, or Solon Goose, is the largest. A fully grown Gannet can easily take a man's finger off at one snap of his powerful beak, and can carry five or six good-sized mackerel at one time. A large specimen of this bird measures seven feet across the wings, and weighs between thirty and forty pounds. The coat of the Gannet is pure white, except for the black tips of its wings and a beautiful golden spot or crown on its head. Its ugly, green, vicious eye is a very unusual one for a bird.

The Kittiwake (from his cry), another of our fairyland birds, is more like a dove, and belongs to the Gull family. He is white, except for pearly-gray wings, tipped with black. The nest of this bird is of seaweed, and this is the only one of the island birds that lays two eggs.

The Murre is another member of this bird colony. The common Murre is about the size of a large duck. This bird is the Razor-billed Auk which is described among our wild birds. The feathers of this bird have a strong oily and fishy odor. Its feathers are much used in the English army, for pillows, and it is necessary to roast the pillows at intervals in order to destroy their odor.

The Puffin is the Sea Parrot. His head and beak are shaped like those of the parrot, and his color is black above and white below; the beak, feet and legs are red. A description of the habits of the Puffin will be found among the Wild Birds.

Mother Cary's Chicken is found on the rock in comparatively small numbers. He belongs to the family called Petrels, and in color is black above and white underneath. This bird flies only at night and its peculiar call has a weird sound in the darkness. This bird lays one egg, in a burrow in a cleft. To see one of Mother Cary's Chickens during the day, one must dig into this underground home.

By some law of their own, the different kinds of birds have divided the nesting-places among themselves, and observe boundary lines very carefully. The Gannets, which are the largest, are given the lower, wider ledges. The Kittiwakes have the next place above these, and the Murres cling to the narrow ridges that offer very little footing. The Puffins and the Mother Cary's chickens burrow among the rocks where there are no ledges.

## TAXIDERMY

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TAXIDERMY is the art of preparing and preserving skins for the purposes of the naturalist, and is also held to mean the stuffing and mounting of the skins, to make them look as like the living forms as possible. No pursuit is more fascinating, whether followed as a hobby or a profession. It abounds in interest and is equally a science and an art.

The equipment of the taxidermist must consist primarily in a knowledge and understanding of the ways and structure of the animal, bird, or fish, he sets out to prepare, and the success of his efforts will depend largely upon his good taste and neat execution. To master thoroughly the art of taxidermy would require years of patient practice and experiment, to say nothing of a sound acquaintance with zoölogy. On the other hand, to taxidermy, as to other things, there are beginnings, and very agreeable beginnings, and the boy or man who has any of the instincts of a naturalist can learn, with reasonable quickness, to become his own taxidermist, and to prepare and handsomely mount the skins of many of the smaller mammals, birds, and fishes. The woods and hills abound in graceful and pleasing little animals that, when stuffed, will still retain a great deal of the natural form and color, though, indeed, no amount of stuffing will ever make a hare or squirrel quite as good to look upon as when he is fleeing through an open space in the wood or scudding along the branch of a tree.

In taxidermy, as in the making of hare soup, you must "first catch your hare," squirrel, chipmunk, fox, weasel, cat, or opossum, as the case may be. Assuming that so much has been done, you will have to be prepared with the materials and tools to carry the work to completion. Let us see what the young taxidermist needs in the way of equipment, taking it for granted that he already has the necessary enthusiasm for the work.

Many of the tools, or at least adequate substitutes for them, will be found in any well-regulated tool box. These are: flat pliers, shears, cutting pliers, file, ratchet hand drill, an assortment of twist drills, brad-awl, saw, vise, monkey wrench, hammer, sharp knives, punch screws, wire nails, staples, calipers, rule and measure, and a supply of twine. Many of these the tyro, doubtless, already has.



In addition, he will find necessary a couple of shoemaker's knives, fashioned to a point for skinning, two scalpels of different sizes, a pair of forceps, a surgeon's fine saw, a bone snip and a bone-scraper, a skin-scraper, a tanner's shaving knife, beam and stretching frame, a steel comb, needle, thread, pins, cotton batting, excelsior, and tow, for stuffing, annealed iron wire, plaster of Paris, glue, papier-maché, iron rod, fitted with screws, bolts and an assortment of washers, plenty of lumber, a stock of artificial eyes of the kind needed, arsenic and powdered alum for preserving skins, salt, and a supply of furriers' sawdust. We have here enough to begin with. As the young taxidermist advances, he will find out for himself the other things indispensable to the work.

Now, having prepared ourselves with the implements, we are in a position to approach the animal to be operated upon. The first business is to measure him, so that when he comes to be mounted it will be easy to preserve his true proportions. As he lies waiting to be measured, it would always be well to sketch his important parts and features as an aid in mounting. Careful note should be made as to the color of all the soft parts, as they lose their color when dry, the color of the eyes, lips and feet, the sex, and, if a wild animal, the locality where it was killed.

There are various ways of measuring animals, but the following measurements are generally followed: The length from the end of the nose, when the head is stretched out, to the joining of the tail with the body; the length of tail from base to end of vertebræ, not to the end of hair; the length of hind foot, from the outer extremity of angle, when the heel is bent at a right angle, to the tip of the longest toe; the height at the shoulders, with the fore feet in their natural position, when the creature stands erect.

Having made and recorded these measurements, it will next be in order to remove the skin. This is an operation requiring care and a little skill, which may always be gained by practice. Many small animals can be skinned neatly without any larger opening being cut than one the length of the abdomen, but as a rule, the amateur had better make an opening extending from the throat to the base of the tail.

With a scalpel, slit the skin precisely in the middle of the neck, always inserting the point underneath the skin and cutting upward so as not to cut the hair, and continue right down the middle to the base of the tail. With the thumbs, the skin at the sides of the cut is pushed away from the flesh, and the skinning is carried carefully to where the fore leg joins the body at the shoulder, and the hind leg at the hip. Cut through the joint, so as to leave the leg in the skin (scissors will do it with small animals), and have the skin in one

whole piece. By inverting the skin over the legs, as you would a cover from an umbrella, the legs may be skinned to the toes. Slit the skin at the bottom of the foot lengthwise. Leave the bones attached to each other by their ligaments and do not detach them from the skin at the toes. Strip away the flesh, leaving the bones bare.

The skin will now invert over the body and can be peeled off freely to the ears. These are severed at the base as were the legs and tail, and skinned down to the tips, when the flesh can be cut away, the cartilage only remaining. The skin is now pulled down over the eyes by loosening the film with the scalpel. Care should be exercised not to cut the skin at the eyelids, and when the lips are reached they should be severed close to the bone and the skull taken out. We have now a hollow skin with a single opening, except for the fleshless but articulated bones of the four legs. The tail should be removed entirely by pulling it out of its sheath.

The next step will be looking toward the preservation or curing of the skin. It should be thoroughly cleaned of flesh, and the whole inside well dusted with a mixture of equal parts of dry powdered alum and arsenic. This preservative powder must act directly upon the roots of the hair from the inside, and, to have it do this satisfactorily, the skin must be as free from flesh and fat as possible.

If you are ready for mounting and have not to pack the skin away dry, it is better to preserve it directly in a salt-and-alum bath. To one gallon of water, take a pint measure of alum and a quart of salt. Boil the mixture, stirring it to dissolve the salt and alum. Pour it into a vessel lined with lead. When it becomes cool or lukewarm, immerse the skin (leg bones and all), being sure that it is as clean as you can get it. Stir occasionally and see that all parts come in contact with the bath. Leave it in the bath, well covered, about two days, and it will be preserved.

After curing, it should be allowed to remain in its bath, so as not to lose its flexibility, but no care need be expended in stirring it, and several cured skins can be piled, one on top of the other, in the same bath. The skull, after removal from the skin, should be cleaned of all fleshy matter, including eyes and brain. A flat wire, bent hook-wise, will remove the brain through the opening at the base of the skull. Do not place the skull in the bath with the skin, but preserve it by anointing it all over with arsenical soap. Afterward you can keep it for study, or use it in the mounting of the skin, instead of using a dummy skull. Fill out the cheeks with stuffing.

To prepare the preserved skin for mounting, it must be thinned by scraping or shaving. The thinner the skin, the better it is pos-



sible to make the expression and modeling of the finished object. A skin-scraper will answer the purpose. Spread the skin out flat, with the inside upward, and scrape it until it is pliable and elastic. Larger skins have to be shaved down almost to the roots of the hair. Any holes that, from one cause or another, exist in the skin should be repaired now by stitching with fine linen thread, from the inside. Then anoint with arsenical soap.

We are now ready to begin building up the form. Large animals require a manikin as framework, but with small mammals we proceed differently. Let us assume that we are mounting a well-shaped squirrel, and take notes as we proceed. First measure the hind leg bones lengthwise, add about eight inches for projection at either end, and cut a piece of No. 15 or 16 annealed wire accordingly. Cut a duplicate piece for the other hind leg. Measure the front leg in the same way, and then cut a piece long enough to reach from the tip of the tail to the end of the nose and leave about six inches over. This makes five pieces of wire altogether. Now introduce the piece for the hind leg through the opening at the sole of the foot, and cause it to fit closely along the under side of the leg bones, to which fasten it with linen thread. Let the wire project about three inches beyond the sole of the foot and about five inches beyond the thigh, for coupling with other parts.

If you have made diagrams or tracings of the outline of the leg, before skinning, they will be of great assistance to you in giving proper proportions. Build up the leg with tow to the proper size and shape, binding in little wads of tow where muscles should be. Do not wind the tow too loosely or it will bag later, nor yet too tightly, or the leg will not bend properly. It would be foolish to attempt this part of taxidermy without having previously studied the contour of the body and limbs. Therefore it is to be presumed that you can make a good rough shape of the proper size. Now coat the tow with arsenical soap and rub on some wet soap, so that it will slip into the covering of skin.

Should the fit in any place be bad, either too tight or too loose, roll the skin back and alter the shape with cotton batting, until you have it as nearly lifelike as you can get it. The leg stuffed, insert chopped tow into the foot and sew up the slit. Bend the wire so that it leaves the foot at right angles. Operate on the other three legs in the same fashion, taking care that the two fore legs, and the two hind legs, match properly.

We have now a skin with four stuffed legs, and we next proceed to the skull. A hole is bored through it lengthwise, a little above the occipital opening, and coming out within the nasal cavity. The cavi-

ties in which flesh existed, you now fill with soft clay or papier-maché, and fill the orbits with the same material. Pass the blunt end of your body wire through the hole made in the skull and out through the nasal cavity, and place it in position within the skin. Drive pins through the skin into the bone at the anterior corners of the eyes, when you have it placed exactly right, and tack the skin to the skull also at the crown, so that it will not shift during the work that follows. You now, by means of a ring twisted around the body wire, fashion with thread a good hard ball of excelsior, on the wire midway between the fore and hind legs. This, perhaps, had better be before the wire and skull are inserted in the skin. You pass the wires of the front legs through this ball and twist them firmly together, bending the end of the twist down into the excelsior.

You next proceed to the tail. The tail end of the body wire must taper finely, otherwise it will not reach the extreme tip of our squirrel tail. Wrap fine tow around the wire to fit the sheath. Try it occasionally, to insure accuracy, having bent the wire so that you can do so easily, without displacing the skull. It is to be hoped that you have not forgotten the arsenical anointing. The tail being in place, you straighten out the body wire and couple the hind legs in the same way as you did the fore legs. You now give to the legs and body the attitude they are designed to assume when finished. You can adapt it to almost any pose you wish.

Here begins the process of stuffing. Chop up fine tow, inserting it with your forceps wherever it is needed. In this your knowledge of the anatomy of the animal will come into play, if you wish to make it natural and lifelike. First, pad out the backbone until you get the desired outline in profile. Then pad the shoulders, forming them with one hand outside the skin, and the forceps in the other. You must be sure that the filling goes in hard and even, so as not to make hills and hollows in the skin. Do not finish any one part until you have given a fair proportion to the whole body. Before the filling is actually completed, place the subject upon its pedestal and work it into its exact intended position. When you have done this satisfactorily, sew up the opening cut underneath.

You now place the specimen back upon its pedestal and, having already bored holes in it in the proper positions, place the feet wires through them and clinch on the other side. Clean the fur of the tow, combing it out with a fine steel comb. Arrange the hair and, if necessary, wash it with soap and water in which a little laundry soda has been dissolved. The specimen is now ready for the final touches. Correct any defects of stuffing, by thrusting a fine sharp awl through the skin and pulling the fiber into the correct shape.



Many defective surfaces can be altered by pressure with the thumbs and fingers on the outside of the skin.

The head remains to be finished. Glass eyes are inserted into the clay-filled orbits. Your own judgment must tell you when these are properly placed. The eyelids are adjusted upon the glass with an awl or large needle. Take care that the same amount of iris shows in both eyes and that they look in the same direction. A little lamp-black mixed with water and applied with a camel's-hair brush to the lids, gives a finished look to the eyes. Clay is introduced between the split lips and about the mouth and the end of the nose. The lips are folded over in their natural place and modeled upon the wet clay. The lips will stay in place, and dry without fastening. The wire projecting from the nose is cut off with pliers close to the bone.

Now arrange each toe in its proper place and give to the tail the position that best comports with the attitude of the body. Put the specimen away to dry. In two weeks, pull out the pins that held the skin of the head in place, and with a little rod beat out the fur so that it will stand out with its life-like electric appearance. You have now a tolerably good specimen for a beginning. If the hair has fallen out, you can easily learn how to repair the bald spots with glue and more hair.

Should you elect to commence with a small bird, you will begin in a somewhat different manner. Measurements are unnecessary, but you must note carefully the color of the eyes, bill, and legs, as bill and legs fade and must be retinted in the finished specimen. You must notice the form and the lie of the feathers on the different parts of the body. Part the feathers, and make an opening straight down from the breast to the vent. Skin with a scalpel or sharp penknife. When the knee joints are reached, cut through with scissors. Throw on corn-meal to absorb any blood that may flow during the operation. Cut the vertebræ at the base of the tail, without cutting through the skin. Turn the skin over, and it is a simple matter to skin down to the head.

The skinning of the head is more difficult. Push the skin gradually, with the thumb, over the head, stretching the skin, so that it will slip over, and the ears can be reached. Cut through the skin close up to the head. At the eyes, skin until you can see the thin membrane and define the eyeball, then sever membrane, taking care not to injure the eyelid. Cut off the skull at the back so as to lay bare the brain, which must be removed. Leave the skull attached to the bill, but clean it of the tongue, eyes, and all flesh. Remove the flesh from the leg bones by inverting the skin over the legs,

and cutting away. Clean base of tail and wings in pretty much the same way; no fat should be allowed to adhere to the skin.

Throughout the operation, use corn-meal freely to absorb the blood and oil from the body and the skin, so that the feathers may not be injured. Cover the skin with powdered arsenic and alum if you wish to preserve the skin as a dry specimen, but if you intend to mount it, use arsenical soap and a powdering of alum. Re-turn the skin, and it is ready for mounting.

Make an artificial body out of tow or wood fiber, conforming in size to the natural one as nearly as possible. It should be wound as firm and hard as you can do it. A piece of No. 18 annealed wire, cut a little longer than the body and neck and sharpened at both ends, is introduced into the artificial body at the place where the neck joins, and is passed completely through, until it comes out where the tail should be. The projecting tail end is turned back upon itself, in the form of a hook, and hammered into the end of the excelsior body. In this position it does not turn, and gives a firm support to the head and neck. To model the neck, wind tow around the neck wire.

Two wires should now be cut for the wings. One is introduced into each wing, from the inside of the skin, the wire lying along the bone to the tip, where it is imbedded in the tissues. Zinc wires are then to be inserted so as to run the whole length of the leg, from the sole of the foot, within the skin at the back of the leg. The wire and bone are wrapped with tow to take the place of the flesh cut away from the leg.

When both legs are wired, the artificial body is introduced into the skin by running the neck end of the wire through the center of the skull and out through the feathers. The wing wires are now clinched to the hard body of the excelsior. Push each leg wire through the center of its side of the false body and clinch it firmly in the excelsior. The legs move freely up and down with the wire. Push them up toward the body, until the heels are in the same position up against the feathers that you have seen them take in the living bird. Insert tow along the thighs, in the crop, and at the base of the tail, and be sure that you get the shape as nearly correct as possible. Work with a living bird or a good picture before you. Sew up the opening, carefully filling in a little tow where needed, as you go along.

After this it is necessary to pin the wings fast to the body and to mount the specimen on its perch and plume the feathers. The eyes are set when the feathers have dried. While the drying process is under way, the feathers should be carefully wrapped to keep them in position.



If the amateur approach the art of taxidermy with a desire to excel and with a sufficient stock of patience and perseverance, the above instructions will guide him safely on the way of preserving and mounting the forms of many beautiful birds, mammals, and reptiles.

## INTRODUCTION

*By FRANK ROE BATCHELDER*

THE Reptiles rank next after the birds and before the fishes in the classification of the animal kingdom by naturalists. They are cold-blooded, like the fishes, but they breathe air, instead of water; they have neither hair nor feathers, and do not suckle their young; they are unlike the mammals and the birds. The Reptiles include the Turtles, the Lizards, the Serpents, the Crocodiles, the Frogs, and the Toads.

Some Reptiles, such as the Turtles, spend the greater part of their time in the water. The animals of this class are good swimmers, for their legs are flattened so as to form paddles; the land-turtles, or Tortoises, have feet that are more nearly of the ordinary form. Other species of Reptiles live in burrows. Some are very slow in their motions, like the Tortoise; while others move swiftly, like the Lizard.

As they are cold-blooded animals, it is natural that the Reptiles should be most numerous, and should attain the greatest size, in the warmest climates. In the temperate regions, they are smaller and fewer in number; in the polar zones, few if any exist.

Reptiles are found in a variety of forms, but all have bony skeletons. The Serpents are long and cylindrical, are covered with scales, and have no feet; the Turtles have the shape of a disk or a dome, and are protected by a thick, hard covering of plates, which form a sort of box; the Lizards have long tails, and sometimes have spines; the Frogs have very long hind legs, which are useful to them in swimming and leaping.

The Turtle depends upon his thick shell to protect him against his enemies, and can withdraw his head, tail, and feet, so that they are covered by it; but he has a sharp beak and great biting power; the Lizard can cast off his tail when an enemy seizes it, or even before, and can leave it wriggling to divert the pursuer's attention, while he seeks a hiding place; some of the Serpents have fangs from which they eject a deadly poison, while others crush their assailants in their coils; the Crocodile has enormous jaws of great biting power, and thick plates of armor; the Toad can throw from his skin an acrid fluid, which may cause his enemy to release his hold. The Lizard has a further means of protection which is shared only by the Tree-toad,—he can change his color very rapidly, so that it will harmonize with his surroundings and make him almost invisible.

Reptiles increase in size slowly, but they live many years. Their senses of touch, taste, and smell, are weak, but they hear well, and some of them have keen sight. They have no voice, but in some cases can make a hissing sound. Their senses are, however, more highly developed than those of the fishes.



Serpents swallow the entire body of their prey at once, and from that fact seem to be greedy, but they really are not so, for, in common with other Reptiles, they eat and drink comparatively little. Reptiles can fast for a long time without reducing their vital energy; Toads have been known to do without food for two or three years; and the Serpents spend the winter in a torpid condition, and require no food for several months.

While the Reptiles do not maintain agreeable family relations, as do birds and mammals, they choose mates for the breeding season, and during that time, in the case of the Serpents, for example, they manifest some devotion to each other. All Reptiles produce eggs; some, like the Crocodile, deposit them in the sand to hatch; others, including many of the Serpents, carry the eggs in their bodies until the young emerge from the shell as tadpoles, without legs, and swim freely in the water, as fishes do; they pass through several stages before they take the form of the full-grown animal.

Reptiles lay more eggs than birds do, but many less than fishes. Lizards lay from eight to twelve eggs; Serpents from ten to one hundred; Turtles from twenty to twenty-four; Crocodiles from twenty to a hundred. The Crocodile watches the nest where she has deposited her eggs, and cares for her young when they come from the shell; those of the Serpents which do not hatch the young within their own bodies, leave their eggs among the grass and leaves, and give them no care.

Some Reptiles have the power to reproduce certain parts of their bodies when broken off; the Lizard renews his tail and the Rattlesnake his rattles. The Serpent changes his skin annually, an act which corresponds to the molting or shedding of feathers by the birds.

The food of Reptiles varies according to the species, but nearly all are flesh-eaters; some, however, eat vegetable food. Serpents catch and eat small animals, and are fond of birds' eggs; Turtles and Crocodiles eat fish; Lizards and Toads devour great numbers of insects.

Some of the Serpents are among the dangerous enemies of man, and many human beings are killed by these Reptiles every year; but from the Turtle and the Frog we obtain delicious food, and the flesh of some kinds of Lizards also is eaten. From the Turtle, too, we get the beautiful substance known as Tortoise-shell, and the skin of the Crocodile is used in making leather. The Toad is actively useful in our fields and gardens, as a destroyer of troublesome insects.

The Reptiles are more repulsive in their appearance than the other animals, but we know that they have their uses, and that they are an essential part of the plan of animal existence.

## REPTILES

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### THE SERPENTS

THE Serpent, or Snake, as he is commonly called, is one of the familiar forms of animal life in all of the warm and temperate parts of the globe. Of the varieties which inhabit our own country, there are only four whose bite is deadly. These are the Rattlesnake, the Copperhead, the Moccasin, and the Harlequin. The others are harmless and timid, and if we study them as intelligently as we do the birds and the fishes, we shall find them very interesting creatures.

The Snake has a long body, which is usually cylindrical, although the body of the Sea-snake is flattened vertically like that of a fish, which makes it easier for him to swim. The Snake's body is covered with scales, and his head, which is generally flattened, is protected by hard plates. Once a year the Snake sheds his skin. It loosens first about the eyes, and then at the mouth, after which the Snake pushes himself through some small crevice, or through a coil of his body, and so draws off the entire skin, which is thus neatly turned inside out, without being broken. A new skin had formed underneath the old one before it loosened, so that the Snake is as well protected as he was before shedding.

All Snakes are flesh-eaters, and frogs, toads, mice, squirrels, rabbits, and birds, form a large part of their food. Nature has given the Snake a skeleton in which the bones are not closely joined, as ours are, but are connected only by ligaments. His jaws, too, admit of being spread wide apart, and he is thus able to swallow animals much larger than himself.

The Snake has no eyelids and cannot move his eyes. His sense of sight is poorly developed, and so, also, is his sense of hearing, although he is quickly attracted by the sound of music, in which he takes great delight. He has a keen sense of smell, however, and can follow his mate by the scent given off from the latter's body. Snakes are dumb, except that some varieties make a hissing sound.

These reptiles glide or push themselves over the ground by means of their ribs, which move back and forth like feet, and their scales are useful in the same way. But a Snake can move forward only



on a surface that is more or less rough, and if placed on a very smooth surface, like glass, he is helpless. He cannot raise more than half his body from the ground, except by the aid of some support like the trunk of a tree or a bush.

Snakes go abroad chiefly by day, although in the tropics, some varieties hunt their prey by night. They are cold-blooded creatures, and seek warm places, such as rocks heated by the sun, where they lie for hours at a time. In winter they crawl into holes in the earth or crevices in the rocks, and remain there, in a torpid state, until warm weather comes again.

They lay eggs, which are oblong in form and have a leathery shell, which yields to the pressure of the finger. Some Snakes lay their eggs in the grass or leaves, and leave them to hatch, while others carry the eggs inside their bodies until they hatch, and so bring forth their young alive.

The simplest division of the hundreds of species of Snakes is into two classes:—those whose bite is poisonous and those which are without venom. The largest Snakes are found in the latter class, but nearly all of the non-poisonous Snakes are timid and retreat in alarm from human beings. Some of them, when cornered, strike at the eye of the person they attack, and in this way may inflict serious wounds.

The Python, which is found in Africa, Asia, and Australia, is sometimes twenty or more feet in length. He winds his tail about the limb of a tree, and lies in wait for his prey until it comes within reach, when he seizes it in his powerful jaws, or if the animal be a large one, quickly crushes it in his coils. He then swallows his prey whole, taking in the head first, and covering the animal with saliva to make it pass more easily into his stomach. It sometimes takes him several hours to do this, and he then lies in a torpid state, perhaps for several days, until his food has been digested and he feels hungry again. The great Boa Constrictor and the Anaconda are South American Snakes, which sometimes reach a length of thirty feet or more. Their habits are like those of the Python.

None of the Snakes which live in this country are as large as the Boa and the Python. All the common varieties are small, and most of them fear us much more than we need to fear them. The Black Snake is common in nearly all parts of the United States. His color is a plain black, which shades to a dark slate color underneath. A large Snake of this species sometimes measures six feet in length, but those ordinarily seen are not more than three or four feet long. He is often found in the neighborhood of streams, where he searches in the thickets for frogs and mice to eat, but he also likes to live on a

rock, basking in the sun, and a colony of Black Snakes often find a home in the nooks of a ledge that affords an abundance of sunshine.

The Black Snake is a good climber; he often crawls up among the branches of trees to search for small birds or eggs. He sometimes enters barns and kills chickens for food, for he can swallow an animal as large as a rabbit. He moves very swiftly, and generally crawls away as fast as he can when he is approached by human beings. The Black Snake has a mild temper, except in the breeding season, when the female is easily irritated. A mother Black Snake has been known to attack a child, whom she endeavored to strangle by winding her coils about the little one's neck, at the same time inflicting severe bites on the face. The Black Snake has no venom, however, and his bite, though painful, will not cause death.

The Green Snake, which is found in moist places and sometimes in trees, is a beautiful little creature with a bright green skin. He is perfectly harmless, and may even be tamed so that he will take food from the hand. Insects are his chief food, for he is not large enough to swallow birds and mammals.

The Milk Snake, the Garter Snake, and the Chicken Snake, are other varieties that are common in this country.

The fresh-water Snakes spend nearly all of their time in the water, where they feed on fish, crabs, and other forms of marine life. Their nostrils are situated at the extreme tip of the snout, so that they can breathe with only the end of the nose above water. The nostrils are provided with valves which close when the Snake dives below the surface. He is a gentle and harmless creature, but if kept in captivity will soon die.

All Snakes have sharp teeth, which point inward and enable them to hold their prey easily. The varieties whose bite is deadly are provided with two long, sharp fangs, which protrude from the upper jaw. These fangs are grooved in front, and above them is a sac filled with venom. When the Snake bites, the venom flows from the sac and enters the skin of the victim where the sharp teeth have punctured it. Soon after the poison enters the blood, it is carried to the heart and paralyzes that organ, causing the death of the person or animal that was bitten. The venom is not harmful unless it enters the blood, and if swallowed produces no bad effect. For this reason, the best way to prevent death from a Snake's bite is to suck the poison directly from the wound.

Pigs, which have a thick layer of fat under the skin, suffer no harm from the bite of a poisonous Snake, because the fangs do not reach the flesh tissues where the blood circulates. This fact is taken advantage of by farmers and others, who admit hogs to fields and



markets that are infested with Rattlesnakes and other venomous insects; the hogs kill and devour the Snakes, until the latter are entirely exterminated. Some Snakes have fangs which are always erect, while in others the fangs lie flat in the mouth until the Snake prepares to bite. These fangs are often broken off, but when this occurs, new ones soon grow in their place.

The Cobra is the most dreaded Serpent in the world, and it is unusual for a person bitten by him to escape death. He is so common in India that several thousand people are said to die every year from his bite. This Snake expands his neck, when irritated or excited, so that it has the appearance of a hood, and his full name—Cobra da Capello—means "Hooded Snake."

The famous Snake-charmers of India use the Cobra in their performances, and handle him without fear, even when his fangs have not been removed, as is sometimes done with poisonous Snakes, when they are kept in captivity. The Cobra is very fond of music, and the Hindoo Snake-charmers always play on a flute, or some similar instrument, when exhibiting their Snakes. It is said that the Cobra does not strike a person who approaches him without fear, but if trodden upon, or suddenly disturbed, he bites quickly and without warning. When a Cobra is killed, his mate often remains near his body, waiting for a chance to avenge his death.

The poisonous Snakes of our own country are the Rattlesnake, the Copperhead, and the Moccasin. Rattlesnakes are not as common in the eastern part of the United States as they once were, because they have been killed or driven away, as the country has become more thickly settled, but in sparsely settled regions they are still numerous. Many exaggerated stories have been told about the size and fierceness of the Rattlesnake. He is seldom more than four or five feet in length, and does not pursue people, but when approached he usually draws himself together in a coil, so as to be ready to strike. At the same time, he lifts his tail and moves it from side to side.

At the end of the tail grow a number of stiff, horny wings, commonly called "rattles," which are loosely joined together, so that when shaken they produce the "rattling" sound that gives the snake his name. If a person hears the rattle in time, he may step back out of danger, but should he come near enough, the Snake will inflict a deadly bite. The rattles are often broken off, but others soon grow in their place, and the belief that the Snake's age is indicated by the number of rattles, one for each year, is a mistaken one. The Rattlesnake lives in crevices in the rocks, on the mountains, or in burrows of the prairie dog, on the plains. His color varies, according

to the length of time he is exposed to the sun, from black to ashy brown on the back, and is lighter underneath.

The Copperhead is the most dangerous of the poisonous Snakes of the United States. He is found only in the South, where he lives in dark, shady places, in high grass, and on the mountains. He is from two to three feet in length, and exhibits a variety of colors. His back is reddish brown, with dark bands around the body, and his head is a sort of bronze copper-color; underneath he is of a pinkish color, spotted with brown. This Snake is very active and ill-tempered, and is greatly feared, for his bite is deadly.

The Water Moccasin and the Harlequin Snake are also found in the South. The former spends his time on low branches of trees or in the water, where he hunts for frogs and fish. His skin is olive colored, barred with black, and is yellow underneath. The Harlequin is the most beautifully colored of the American Snakes. His head and tail are ringed with black and yellow, and on his body these colors are combined with deep red. He lives underground, and is often brought to the surface by the hoe in sweet-potato fields and similar places.

The Sea-snake lives entirely in the water. He has a broad tail which is shaped like a paddle, and he is a swift swimmer. He uses his poison to kill the fishes, on which he feeds, and as a fish dies instantly when bitten, he cannot erect his spines, or give the Snake any trouble in swallowing him. The Sea-snake sometimes attains a length of eight feet or more, but is never long enough to pass for the fabulous "sea serpent." His bite is deadly to man, but when taken from the water he seems unable to see, and may easily be avoided.

## THE ALLIGATOR

THE rich, reddish-brown leather of an Alligator-skin traveling bag or a lady's Alligator-skin purse is very handsome, but, except in its roughness, it does not suggest the unpleasant looking reptile from whose hide it was made.

The Alligator is a native of America and is not found on the other continents, although the crocodile of the old world is found in this Hemisphere as well. Alligators and crocodiles belong to the same family, but the Alligator differs from the crocodile in having his feet much less webbed and in spending much less time in the water. Besides these differences, he has a shorter and flatter head and his teeth differ from those of the crocodile.

The Alligator is better known as a native of Florida than of any other part of the United States, but there are several species which



are found in the marshes and bayous of all the Gulf states, and in the Mississippi River as far north as the mouth of the Ohio.

Alligators spend the greater part of the day in basking in the sun, on a mud bank or a heap of floating débris. When lying motionless on the surface of the water, they very much resemble logs, for which they are sometimes mistaken. They are active at night and swim about in search of fishes, which constitute their chief food. They eat other kinds of flesh, however, and are said to be especially fond of that of the dog.

The Alligator, like the crocodile, seizes his prey and sinks with it below the surface of the water, where he remains until his victim drowns. At the base of his tongue is a valve, which closes when he is submerged, and thus prevents the water from entering his lungs even though his mouth remains open, while holding his prey. His breathing apparatus is so arranged that he can breathe by merely putting his nostrils above water and drawing fresh air into his lungs.

Some species of Alligator are inclined to be pugnacious when disturbed in their own haunts, and especially at night. They are amazingly quick to detect any mischance that happens to a man, such as the loss of his oars, the leaking of his boat, or anything else that may put him at their mercy. In such a case they will follow, or remain near him, for hours, making such efforts as they can to get at him, for they are very fond of human flesh.

In attack or defense they use both jaws and tail, and with the latter they can strike a crushing blow, or sweep a man off his feet and into the water, where he is immediately placed at their mercy.

The breeding season of Alligators is in the spring and early summer, and at that time they bellow loudly and make a tremendous disturbance, especially at night. The female digs a deep hole in the sand and in it lays her eggs, which she arranges in layers, with leaves and sand separating each layer from the one next above it. Over the nest she makes a little hillock of sand, and then waits for the sun to hatch the eggs. These vary in number from twenty to sixty, and are about the size of a goose egg. During the hatching period, the mother Alligator remains near the nest, to see that it is not disturbed. When the little Alligators appear, they are about three or four inches in length, and are very cunning indeed. As soon as they emerge from the shell they go at once into the water, and their proud and excited mother takes them in charge and gives them good care for several weeks.

Full-grown Alligators vary in length, from two to fifteen feet, according to the species, though it is seldom that one reaches a length of more than twelve feet. Travelers and hunters tell us marvelous

stories of Alligators from twenty to thirty feet in length, but it is easy to imagine that if we were fishing for some small fish, such as perch or bass, and suddenly saw an Alligator coming toward us, we would be likely to think he was about twice his real size.

When winter comes, the Alligator buries himself in the mud and sleeps until spring. During the cold season he can be dug out and cut in pieces without being aroused, but if he is put in a warm room, he very soon becomes active.

The hide of the Alligator makes a strong, durable leather, and the demand for it during the past few years has resulted in the killing of so many Alligators that they are not so plentiful in our southern states as they once were. Oil is obtained from the Alligator, and the flesh is sometimes eaten, but it has a musky flavor and is not very palatable.

## LIZARDS

THE members of the Lizard family resemble the serpents in having long, slender bodies, which are generally covered with scales or plates, but, unlike the snakes, most of them have four legs, on which to walk, or run, instead of crawling. Some species are still more like snakes, and have long, round bodies, with only two very small feet near the head. In a very few varieties no feet are visible, but on examination they are found underneath the skin.

There are so many kinds of Lizards, that it would take many pages to tell even a little about each. They are found in all the warm and temperate countries of the world, and vary in size from little creatures only two or three inches in length to those which measure four or five feet. Most of them are timid, harmless creatures, and their habits form an interesting subject for study.

All the smaller Lizards are insect-eaters, and they deserve the good will of mankind, for they destroy immense numbers of harmful insects. They are most active in the middle of the day when the birds are at rest, and, as destroyers of insect pests, they really take the place of the birds, for the time being. Nearly all Lizards lay eggs, though a few bring forth their young alive. Some deposit their eggs in crevices, among rocks or under leaves, while others secrete them in nests in hollow trees, and in other similar places. Some kinds live on the ground, while others live together in trees; some spend the greater part of their time in the water, while others burrow in the sand; thus we see that they have many varied traits, and are fitted to live in all sorts of places.

The Gecko is a Lizard about fourteen inches in length, which is found in Asia. He feeds principally on insects, but sometimes eats



his young, and, rather than starve, will eat his own tail. This last is hard to believe, even when we are told that Lizards have the wonderful power of reproducing their tails when they lose them. The tail of a small Lizard may easily be broken off by the flick of a pencil or a handkerchief. But the Lizard, himself, often breaks off his own tail when he is seeking to escape an enemy. The part that is broken off continues to wriggle for some time and thus distracts the enemy's attention, while the Lizard slips into some nook, where he is safely hidden. The muscles of the creature's body at the root of the tail contract so as to prevent bleeding, and in a little while a new tail grows in place of the old one.

The Gecko makes his way into houses, and runs up and down the walls and across the ceilings. His feet are provided with suction disks, so that he can hold to the ceiling while walking with his head downward. These little creatures may be easily tamed, and will soon learn to eat from a person's hand. There is a variety called the "Flying-gecko," which has webs between his legs similar to those of the flying-squirrel, and he can sail through the air in the same way.

The Iguana, which is found in the West Indies and in South America, is one of the largest members of the Lizard family, sometimes attaining a length of five feet or more. He presents an uncouth appearance. He eats only flowers, fruits, mushrooms, and mangrove leaves, and this diet makes toothsome food of his flesh. During the heat of the day, the Iguana climbs a low tree and stretches himself out to enjoy the sun. He may easily be approached, and, if tickled under the throat with a twig, is so greatly pleased, that he forgets his danger, and thus may be caught by passing a slipnoose over his head.

The Basilisk is a Lizard about three feet long, which is found in Central America and Mexico. In ancient times these creatures were thought to have supernatural powers, so that their breath or their glance would kill any one who came near them. Of course this was the veriest nonsense, for the Basilisk is really a harmless and inoffensive creature. Hundreds of years ago, people did not study the habits of the dumb creatures as we do now. The more we learn about them, the better we like them; and we have also the satisfaction of knowing that we are progressing in knowledge.

The Chameleon of the Old World is one of the most remarkable of the Lizards. He has the power of changing his color to match that of any object upon which he may be resting. If he rests upon a leaf, his color is green; if upon a tree-trunk, he is brown, and so on. This prevents his being seen, either by his enemies or by his prey, which

consists chiefly of insects. He has a very long, slender, tube-shaped tongue, which darts from his mouth, captures an insect, and is withdrawn in a twinkling. He has a long tail, with which he can cling to branches, and an oddly shaped head, with great bulging eyes. The little American Chameleon has a different shape, but has the same wonderful power of changing his color, from one tint to another, and back again. These Lizards sometimes enter houses, for they show little fear of man. They are afraid of the cat, however, for puss catches and eats them whenever she can.

The "Horned Toad," which is found in California, Texas and other parts of the southwest, is a little Lizard, covered with sharp spines which make him look very formidable. But he is very inoffensive and bashful, and, if he thinks he is attracting notice, tries to hide by flattening himself to the ground as much as possible. By tickling his sides, he may be made to puff up with pleasure.

The "Gila Monster," a Lizard found in New Mexico and Arizona, has a coat of mail, composed of little tubercles, which looks like the surface of a nutmeg grater. He is beautifully marked with black and orange, but is a repulsive-looking creature. His bite is poisonous, and he resents any attempt to handle him.

The great Water-lizards of Africa and Asia are sometimes four or five feet in length. They feed principally on water animals and birds' eggs. Those of one species, called Monitors, seldom leave the water, except to search for crocodiles' eggs, of which they are very fond. They break open the nests and devour hundreds of eggs, in a short time, thus preventing too fast an increase in the crocodile family.

The small Ground-lizard of the southern states has a beautiful coat of dark brown, which shades into pink, yellow, and blue. The little green Lizard, which is common in many parts of our country, is also remarkable for his beautiful color. These little creatures live in nooks and crevices about our houses and barns, and do no harm to any one, but, on the contrary, render good service by eating flies and other insects, of which we are glad to be rid.

## THE FROG

THE reason why the mere sight of a Frog should tempt even a hard-hearted boy to throw stones at him, is hard to guess; of course, no kind-hearted boy would be so tempted. The Frog is one of our most familiar friends. His cousins are found in nearly all parts of the world, and the habits of the various members of the family are much the same.



The Frog lives near the water and spends a large part of his time in it. The growth of a Frog from the egg is a very interesting thing to watch. The female Frog spawns as a fish does, and the eggs, in round masses, are fastened to sticks or plants in the water. He is born only half an inch long, but he grows in size very rapidly. At first he seems all head and tail, for he has a long tail and no legs. The Tadpole is more like a fish than like a Frog, and breathes water through gills, as fishes do.

After a time two bunches appear near his tail, and in a short time they change to legs. Front legs also appear later, and as all these become perfect, the long tail grows gradually shorter and finally disappears. By the time the tail has disappeared, the Tadpole has become a real Frog, and can breathe air through his lungs; so he goes ashore in search of insects and worms for food. In damp weather, little Frogs sometimes appear in such great numbers that they are believed by people to have "rained" from the clouds. That is only one of the many foolish explanations that people used to give when they did not know the true reason for unusual occurrences.

The Frog has a smooth skin. The common Bull-frog—our old friend who makes remarks about wanting a "jug-o'-rum, jug-o'-rum"—is green in front, dusky olive behind and yellowish white underneath. He measures from eighteen to twenty inches in length. He is a famous jumper, for his long legs make it possible for him to put great energy into a spring; and he has a voice that can be heard a long distance on a still night. He is a fine swimmer, and a greedy feeder on worms, snails, mice, snakes, insects, young birds and his own Tadpoles. He eats only the prey which he catches alive, however, and is no scavenger. The little Tadpoles are equally greedy and less critical in taste. They devour decaying flesh with a relish, and are sometimes employed to remove the flesh from very delicately articulated skeletons, which cannot be easily cleaned by any other method.

The male Frog is always the loudest croaker. In Brazil there is a Frog called the Blacksmith Frog, whose croak is so loud that it sounds like the clanging of a hammer on an anvil.

Frogs are altogether harmless creatures, and they are useful, as well, for they eat many troublesome worms and insects. They are, themselves, excellent for food, and the flavor of Frogs' legs, fried, surpasses that of the best chicken. Great quantities of Frogs' legs are now eaten in this country, as they have been for many years in Europe.

The Frog has been of great value to man as a subject for the study of physiology, for he has a remarkable hold on life, and can live some time after his heart is removed. Many truths about the circulation of the blood have been learned from this humble creature.

## TURTLES

TURTLES and Tortoises belong to the same family of reptiles. The name Turtle is ordinarily given only to the species that live in the water, while the term Tortoise is applied to species that live partly in the sea, and to others that live wholly on the land. As a matter of convenience, however, all the members of this family are spoken of as Turtles.

The Turtle has a short, flattened body, with four short legs and a flexible neck. He is remarkable for his protecting cover, or "shell," as it is generally called. This shell consists of an upper and lower plate, sometimes immovably joined, and in other cases unattached to each other, which are really a form of skin or scale that is as hard as bone. Between these two thick plates, the upper of which is called the carapace and the lower the plastron, is the soft body of the Turtle, which has a bony skeleton, independent of the outside covering. When the Turtle is alarmed, he can withdraw his legs and head between the upper and lower lids of his shell, which is his method of escape from his enemies. Some Turtles can bring the carapace down so as to leave no space between it and the plastron, thus completely inclosing the creature in a sort of box.

The Turtle has a strong beak or bill similar to that of a bird, and he has no teeth. His eyes are each provided with an extra lid, which moves from the side, in addition to the ordinary upper and lower lids. In this he resembles the bird, as well as in laying the eggs. The female lays two or three hundred globular or oblong eggs, in a hole which she scoops in the sand with her hind feet. She then covers the eggs with sand and leaves them to be hatched by the heat of the sun. When the little Turtles appear, they dig their way through the sand above them and hurry to the water. Their parents give them no attention whatever, and from the time that they are born, they are obliged to look out for themselves. Turtles often live to be very old, and instances have been known where these creatures have reached an age of one hundred, one hundred and fifty and even two hundred years. They are not voracious eaters for creatures of their size, and can fast for a long time without perceptible loss of flesh.

The Turtles that live in the sea have legs which are broadened and flattened into flippers, so as to be more servicable in swimming than the simple webbed feet of the land-tortoise. One of the largest of the sea-turtles is the Leather-back Turtle, which has a covering that is not so hard as that of other turtles, but more nearly resembles



leather. These turtles grow to a length of more than six feet, and often weigh a thousand pounds or more.

The Green Turtle, which is found along the Atlantic coast from Cape Hatteras to Brazil, is sought after more than any of the other sea-turtles, for his flesh is excellent food. He feeds wholly on vegetable substances, his chief article of diet being the roots of eel-grass. In the breeding season, the female seeks a low, sandy beach, and at night leaves the water and deposits her eggs in the sand. She digs a hole in which she lays from one hundred to two hundred eggs, which are about the same size as those of a hen, but are spherical in shape. A fortnight later, she makes another nest and lays a like number of eggs, and repeats this operation until she has laid perhaps a thousand eggs in all. She leaves them all to be hatched by the heat of the sun and gives them no further thought.

During this period of egg-laying, the Turtle-fisherman watches for the Turtle to leave the water. When she is some distance from its edge, he appears and, as the Turtle cannot run rapidly, he turns her on her back by means of a pole which he thrusts beneath her. Once on her back, the Turtle is helpless, and must lie there until removed. After capturing the Turtles, the fisherman confines them in a pen, or "crawl" at the edge of the sea, where they can have access to the water, and in this way they are kept until wanted for shipment to market. The eggs, as well as the flesh, are much sought articles of food. The Green Turtle is sometimes six or seven feet in length and weighs seven hundred pounds or more, but the average specimen does not weigh more than four hundred pounds.

The Hawk-bill Turtle, or Caret, which is found in the southern oceans, is the chief source of supply of the beautiful tortoise-shell that is used in making combs and inlaid work, and for other purposes. This Turtle is from a foot and a half to three feet in length, and the shell is about an eighth of an inch in thickness.

The fresh-water Turtles have legs which do not end in flippers, but in distinct feet, suited for walking as well as for swimming, for they spend a part of their time on the land, while the sea-turtles leave the water only to deposit their eggs.

The Painted Turtle is the most beautifully marked of our American fresh-water Turtles. The dark brown scales or plates of the carapace are bordered with yellow, and there are deep red markings on the outer margin. This Turtle is only about six inches long, four inches wide and two and one-half inches in height. He is a very timid little fellow, and spends the greater part of his time basking on a log or rock, from which he can quickly slide into the water and disappear from sight, when alarmed. He eats insects, worms and





FROM COL. L. E. DANIELS.

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GEOGRAPHIC TURTLE.

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Sunrise Shell (*Tellina radiata*)  
 Cockle (*Cardium isocardia*)  
 Mussel (*Mytilus edulis*)  
 Fresh Water Clam (*Unio luteolus*)

Spiny Oyster (*Spondylus princeps*)

Pearl Oyster (*Margaritophora radiata*)  
 Scallop (*Pecten dislocans*)  
 Oyster (*Ostrea lacerans*)  
 Spiny Venus (*Cytheria lupinaria*)



tadpoles, and often bites at the fisherman's hook, greatly to the annoyance of the angler.

The Geographic Tortoise is a bold, active fellow, about eight inches long, whose name comes from the irregular network of reddish-brown lines on his carapace, which resemble the lines of a map. He is found in the middle and southern states.

The Common Snapping Turtle is very strong and can bite off a man's finger with one snap of his horny beak. He is a pugnacious creature, and if prodded with a stick, seizes it in his jaws and refuses to relinquish his hold, even when he is lifted from the ground.

The Gopher Tortoise, which is common in the southern states, is a sociable creature and the members of this species often travel about in troops. They are land-turtles and live in burrows dug in dry or sandy soil, where they spend the winter in a torpid condition. They seek their burrows at the first hint of rain, which is very disagreeable to them, and while they sometimes bask in the sun like other Turtles, they avoid its direct rays. They prowl about at night, and as they feed wholly on vegetables, they sometimes do considerable mischief in the farmer's potato field or turnip patch. The Gopher Tortoise lays but five eggs. The female is larger than the male and grows to a length of about fifteen inches. She is also the stronger of the two, and a female Gopher Tortoise has been known to walk while bearing a weight of two hundred pounds.

The great Galapagos Tortoise, which is found in the Galapagos Islands, is the largest of the land-turtles. When he is full grown he is twelve or more feet in circumference.

## THE CROCODILE

THE Crocodile is the largest reptile in existence at the present time. His family comprises several different species, but all have about the same shape and general appearance. The body and head are long and flattened and the legs are very short. The toes are webbed, for the Crocodile spends the greater part of his time in the water and is a good swimmer. From the head to the tip of the long tail, his body is covered with bony plates, which are so hard that a rifle bullet will not pierce them, unless it strikes squarely.

Crocodiles are found in the warm countries of both the Old World and the New. They live along the banks of rivers and marshes, but not on the shores of the sea. In some species the snout is much more slender than in others, but all of them have enormous jaws and sharp teeth. The famous Crocodiles of the Nile River, in Africa, grow to a



length of about thirty feet, and are of a bronze-green color, marked with brown. They are voracious eaters and often prey on human beings.

When the water is low in the stream he inhabits, the Crocodile buries himself in the mud, where he remains in a torpid state until the water rises again. The female Crocodile lays her eggs in the sand or mud, covers them over and leaves them to be hatched by the heat of the sun; but she does not go far from the nest, and watches to see that the eggs are not disturbed.

Both fishes and mammals are eaten by the Crocodile. He prefers decaying flesh to that newly killed, however, and often leaves his prey to decompose before he eats it. This great reptile lies motionless in the water for hours at a time, with only his eyes and the tip of his snout visible above the surface. When cattle or other animals come to the stream to drink, the Crocodile glides stealthily through the water and seizes the head of his victim in his powerful jaws. He then draws back into deep water and drags his prey beneath the surface, where he holds the creature until it drowns.

He has a very clever way of enticing dogs to his hiding place, which has caused many a hunter to mourn the loss of his four-footed companions. The Crocodile gives utterance to a sound which very closely resembles the bark of a dog, and any dog that happens to be near hurries in the direction of the sound, expecting to find one of his fellows. The Crocodile continues to "bark" until his victim is attracted to the bank of the stream in which the great reptile lies concealed, when the dog falls an easy prey to his powerful enemy. If given an opportunity, a Crocodile will seize a man or a child, and in Africa or Asia, no one but a stranger would ever think of entering the water for a swim.

If attacked on land, the Crocodile is at a disadvantage, both because of his great weight and short legs and because his neck is so made that he cannot turn his head. If a man dodge briskly, the Crocodile cannot turn quickly enough to catch him, unless the animal is able to knock the man down with a sweep of his great tail. But in the water, the reptile is an active and dangerous foe, for there he moves quickly and appears at unexpected times and places. He does not hesitate to attack men in boats, and has been known to crush a boat, either with his powerful jaws or with a blow of his great tail.

When the Crocodile is not seeking food in the water, he crawls out on the bank and lies for hours motionless and silent, basking in the sun. There is a little bird which dances attendance upon him, and which the Crocodile recognizes as a friend. He opens his great jaws, and the little bird fearlessly hops into the reptile's mouth and there devours the flies which annoy the Crocodile. All other birds

fear the great reptile and fly from him, but the crocodile bird has confidence in him, and the Crocodile never harms his feathered friend.

Crocodiles were worshiped as deities by the ancient Egyptians, who housed the reptiles in magnificent temples, covered them with trappings of gold and precious stones, and fed them on dainties. In India, the ignorant and superstitious natives of certain religious sects still venerate the Crocodile, as the Egyptians did thousands of years ago, and these natives make religious sacrifices by throwing babes into the rivers to be devoured by the reptiles. The Crocodile is a loathsome creature to look upon, and it is hard to understand how even the most ignorant people could worship him. But they did so, no doubt because they feared him, and hoped, by acts of worship and by gifts, to make him kinder to them.

## THE TOAD

OUR friend the common Toad is even more useful to mankind than the Frog, although we do not eat his flesh. He is not so handsome as the Frog, it is true, for he has a rough dead-colored skin, which is covered with unsightly warts. His feet are not webbed for swimming, like those of the Frog, for he enters the water only during the spawning season, and as he is a land animal, nature has made his toes distinct. The Toad has no teeth, but is provided with a very long tongue. He feeds chiefly upon insects and slugs, and when within reach of his prey, he darts out his long tongue, which seizes the insect and draws it into the Toad's mouth. He swallows his food whole, and if the tidbit be a long worm, he uses his fore feet to push the worm into his mouth.

In the spring, Toads enter the water and deposit their eggs in a manner similar to that of Frogs. The young Toads pass through the tadpole stage in the water, but after they have become fully developed Toads, they leave the water and return there only to spawn. The Toad spends the greater part of his time in moist, shady places, and avoids the sun. He cannot take such long leaps as the Frog, but crawls or hops over the ground, generally moving but a few feet at a time.

The Toad makes a piping sound, which he repeats until it becomes very monotonous, but otherwise he gives us no trouble. On the contrary, he does a great amount of good by devouring thousands of insects and worms, which attack our flowers, fruit and vegetables. Many of these are most active at night, when nearly all the birds are asleep,



but Mr. Toad attends to business all night long, and it is astonishing to see how many insects he will devour.

The Toad's warts secrete an acrid fluid, which, in some species, gives off an offensive odor, and when a dog picks up a toad in his mouth he quickly drops the creature. But the old stories that Toads are poisonous and dangerous to handle are without foundation, although the acrid secretion of the skin may cause a local irritation, if introduced into a cut or raw wound. Mr. Toad, on the contrary, is an amiable fellow, and is glad to make friends with human beings. He may be tamed so that he will come and eat from our hands, and he soon grows to recognize those who are kind to him. Unless injured in some way, these creatures often live to be forty or more years of age.

During the winter the Toad lies in a torpid state, in a hole under a stump, in a crevice, or in some similar place; but with the first appearance of the bugs and worms in spring, he comes out for a long-delayed breakfast.

Our common Toad is but three or four inches in length, but, in the warm countries of the tropics, there are Toads of larger size. One of these is the remarkable Surinam Toad, which is found only in South America. When the female of this species lays her eggs, the male at once takes them and places them on her back. There the skin gradually grows around and over them, and, thus protected, the eggs reach maturity, when the young Toads hop from their mother's back and begin an independent existence. The number of eggs carried by the Surinam Toad on her back varies from forty to one hundred and twenty.

The Tree-toad, or Tree-frog, as he is also called, resembles our common Toad in form, but his body is more flattened, and he is seldom more than two inches in length. He is fitted by nature for climbing, since he is provided with sucking disks on his feet, like those of the Gecko Lizard. He has a vocal power quite out of proportion to his size, and is very noisy in the spring and summer. The Tree-toad can change his color to harmonize with his surroundings like the Chameleon, so that while clinging to the bark of a tree he may be brown, and the next moment, when found on a leaf, he will be green.

In Borneo is found a Flying Tree-frog, that has very long toes, which are fully webbed. These serve to support him in leaping through the air, in the same manner that the membranes of the flying squirrel support that animal.

## THE STORY OF THE FISH

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A FISH is a back-boned animal which has always lived in the water and always expects to live there. Its ancestors have always lived there and most likely its descendants always will. And so, as the water is a very different region to live in from the fields or the woods, a fish is made very different from the birds and the beasts that breathe air and walk or fly above the ground and out of the water.

If we want to understand a fish, we must first go and catch one. This is not very hard to do, for there are plenty of them in the brook or among the lilies of the pond. Let us take a little hook, put on it a worm or grasshopper and go out to the "old swimming-hole" or to the deep eddy at the root of an old stump, where the stream has eaten into the bank on account of a change in its course. Here we are sure to find fishes, and one of them will take the bait very soon. In different parts of the country, the first fish that bites will not be always of the same kind. But let our brook be in New England or New York or Michigan and we can be pretty sure that it is a Sunfish, or as some call it, a "Sunny,"\* or "Pumpkin Seed." It is a little fish, not so big as your hand, but it will seize the bait savagely and swim away with it with all its might, and you may think you have a pickerel or a bass. But when it comes out it is a little, flapping fish, broad and plump, with its fins wide-spread and its round eyes red as if with rage.

And now we have put it into a bucket of water, where it lies close to the bottom. Then we take it home and place it in an aquarium, and for the first time we have a chance to see what it is like. We see that its body is almost as round as a dollar, but with flat sides, and shaped on the lower parts very much like a boat. This we see is to enable it to part the water as it swims, and we notice that it is a sort of stern-wheeler, moving by the sculling motion given to it by its broad, flat tail.

When we look at it from the front, we see that it has a sort of face, which we didn't know before that fishes had. The big eyes, one on each side, stand out without eyelids, but the fish can move them at his will, so that once in a while he seems to wink. There isn't much of a nose between them, but the mouth is in the right place, and the fish opens and shuts it as he breathes. We soon see that he breathes water, taking it in through his mouth and letting it flow over his gills, and then out through the opening behind the gill covers.

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\* Called in the books, *Eupomotis gibbosus*



If we take another fish (we shall not kill this one), we shall see that in its throat behind the mouth cavity, there are four rib-like bones on each side, above the beginning of the gullet. These are the gill-arches, and on each one of them there is a pair of rows of red fringes called the gills. Into each of these fringes runs a blood vessel. As the water passes over it, the oxygen it contains is absorbed through the skin of the gill-fringe into the blood, which thus becomes purified. In the same manner, the impurities of the blood pass out into the water, and go out through the gill-openings behind. The fish needs to breathe just as we do, though the apparatus of breathing is not the same. Just as the air becomes loaded with impurities when many people breathe it, so does the water in our jar or aquarium become foul if it is breathed over and over again by fishes. When a fish finds the water bad, he comes to the surface to gulp air, but his gills are not well fitted to use this as a substitute for water. The rush of a stream through the air purifies the water, and so again does the growth of water plants, for those in the sunshine absorb and break up carbonic acid gas and throw out oxygen into the water. On the inner side of the gill-arch we find some little projections which serve as strainers to the water. These are called gill rakers. In our Sunfish they do not amount to much, but they are very large in a herring.

Behind the gills, at the opening of the gullet, are some roundish bones, armed with thick, blunt teeth. These are called pharyngeals. They form something like jaws in the throat, which are useful in helping the little fish to crack shells. If we look at the mouth of our live fish, we shall find that it moves the lower jaw when it breathes or bites, very much as a dog does. But it can move the upper jaw, too, a little, and that by shoving it out in a queer fashion, as though pushing it out of a sheath, and then drawing it in. If we look at our dead fish, we shall see that the upper jaw divides in the middle, and has two bones on each side. On one bone are rows of little teeth, while the other bone that lies behind it has no teeth at all. The lower jaw has little teeth just the same, and there is a patch of teeth on the roof of the mouth, also, and in some Sunfishes, three little patches.

The tongue of the fish is flat and gristly. The fish cannot move it, much less lick its food with it, or even use it for talking. The unruly member of a fish is not its tongue, but its tail.

Now we come around to the fish's eye again. We saw that it has no eyelids, and so, if the fish ever goes to sleep, it must keep its eyes wide open. The iris is brown or red. The pupil is round, and if we could cut open the eye, we should see that the crystalline lens is a perfect sphere, much more convex than the lens in the eyes of land animals.

We shall learn sometime that this is necessary, for the fish sees under water, and a very round lens is necessary to make images there. This makes the fish very near-sighted. He cannot see clearly anything out of water or at a distance. Thus he has learned that when, in water or out, he sees anything moving quickly, it is probably something dangerous, and the thing for him to do is to swim away and hide.

In front of the eye are the nostrils, a pair on each side. But they open only into a little cup, lined with delicate pink tissues, and the branching nerves of smell. The nostrils do not make a tube, and the fish does not use them at all in breathing. But they tell him where there is anything in the water that is good to eat, and eating is about the only thing a fish cares for.

Behind the eye there are several bones on the side of the head, which are separate from the real skeleton. These are called membrane bones, because they are skin turned to bone by the deposition of salts of lime in it. One of these is called the opercle, or gill cover, and before it, forming a right angle is the pre-opercle, or false gill cover. In our Sunfish we see that the opercle has a flap behind that looks like an ear. This is black, and at its tip there is a bright dash of scarlet, as though a drop of blood were splashed upon it. When the fish is in the water, its back is dark-greenish looking, like the weeds and the sticks in the bottom, so that we cannot see it very plainly. This is his way of dodging the fishhawks or herons in the air above, who may come to the stream to look for fish. By looking like the bottom, it is easier for the fish to hide and save himself. The under side of the Sunfish is paler, and most fishes have the belly white. Fishes with white bellies swim high in the water, and the fishes who would catch him lie below. To the fish in the water, all the outside atmosphere looks white, and so the white-bellied fishes are hard to see, just as it is hard for us to see a white rabbit bounding over the snow.

But to be known of his own kind is good for the Sunfish, and we think that the black ear-flap, with its scarlet tip, helps his mate and friends to find him out, where they swim on his own level near the bottom. Such marks are called recognition-marks, and a great many fishes have them, but it is easier to guess at their use than it is to be sure of it.

We are certain that the ear-flap is not an ear, however. No fishes have any external ear, all their hearing apparatus being buried in the skull. They cannot hear very much, possibly only a great jar or splash in the water, but whenever they hear any noise, they swim off to a hiding-place, for whenever anything is going on in the water, there is danger for some fish. The color of the live Sunfish is very brilliant. Thoreau compares it to a "coin fresh from the mint." Its body is covered with scales, hard and firm, overlapping one another like shingles on a roof, and making a close coat of mail. Over these is a thin skin, in which are set minute globules of bright-colored matter, scarlet, blue, green, brown, and black. These give the fish its varied colors. Some coloring matter is under the scales as well, and this especially makes the back darker than the lower parts. The bright colors of the Sunfish change with its surroundings or with its feelings. When it lies in wait under a dark log, its colors are very dark. When it rests above the white sands, it is very pale. When it is guarding its nest from some meddling bass, its red shades flash out as it stands with fins spread, as though a water knight with lance at rest, looking its fiercest at the intruder.



When the Sunfish is taken out of the water, its colors seem to fade. In the aquarium it is generally paler, but it will sometimes brighten up when another of its own species is placed beside it.

The cause of all this seems to lie in the nervous control of the muscles at the base of the scale. When the scales lie very flat, the color has one appearance. When they rise a little, the shade of color seems to change. If you let fall some ink drops between two panes of glass, then spread them apart or press them together, you will see changes in the color and size of the spots. Of this nature is the apparent change in the color of fishes under different conditions. When the fish feels at its best, the colors are the brightest. There are some fishes, too, in which the male grows very brilliant in the breeding season through the deposition of red, white, black or blue pigments, or coloring matter, on its scales or on its head or fins, this pigment being absorbed when the mating season is over. This is not true of the Sunfish, who remains just about the same at all seasons. The male and female are colored alike and are not to be distinguished without dissection. If we examine the scales, we shall find that they are marked with fine lines and eccentric striæ; part of the apparent color is due to the effect of the fine line in the light. This gives the bluish luster or sheen that we can see in certain lights, although we shall find no real blue pigment under it.

The inner edge of each scale is usually scalloped or crinkled, and the outer margin of most of them has little roughish points, which make the fish seem rough when we pass our hand over it.

Along the side of the fish is a line of peculiar scales, which runs from the head to the tail. This is called the lateral line. If we examine it carefully, we shall see that it is made up of a row of tubes which secrete a watery or mucous fluid. Behind these tubes are nerves, and although not much is known of the function of the tubes, we can be sure that in some degree the lateral line is a sense organ, perhaps aiding the fish to feel sound waves or other disturbances in the water.

The fish moves itself and directs its course in the water by means of its fins. These are made up of stiff or flexible rods growing out from the body and joined together by membrane. There are two kinds of these rays or rods in the fins. One sort is undivided and unbranched, tapering to a point. The rays thus fashioned are called spines, and in the Sunfish they are stiff and sharp-pointed. The others, known as soft rays, are made up of many little joints, and most of them branch and spread out, brush-like, at their tips. In the fin at the back, the first ten of the rays are spines, the rest are soft rays. In the fin under the tail, there are three spines, and in each fin at the breast there is one spine with five soft rays. In the other fins all the rays are soft.

The fin on the back is called the dorsal fin; that at the end of the tail is the caudal fin; the one just in front of this on the lower side is the anal fin. The fins, one on each side, just behind the gill openings, are called the pectoral fins. These correspond to the arms of man, the wings of birds, or the fore legs of a turtle or lizard. Below these, cor-

responding to the hind legs, is the pair of fins known as the ventral fins. If we examine the bones behind the gill openings, to which the pectoral fins are attached, we shall find that they correspond to the shoulder girdle (shoulder bone and collar bone) of higher animals. But the shoulder bone in the Sunfish is joined to the back part of the skull, so that the fish has no neck at all. In animals with necks, the bones at the shoulder are placed at some distance behind the skull.

If we examine the hind legs of a fish, the ventral fins, we shall find that, just as in man, these are fastened to a bone inside the flesh called the pelvis. But the pelvis in the Sunfish is small and is shoved far forward, so that it is joined to the tip of the "collar bone" of the shoulder girdle. In man we have the whole back lying between the shoulder girdle and the pelvis. But the Sunfish has the two right together. Strictly speaking, its vertebral column consists of head and tail only, there being no real neck or part between the head and shoulders and no real back or part between the shoulders and pelvis.

If we examine other fishes, we shall find that the more old-fashioned types are differently made. The chub, the dace and the trout, have a long back, the pelvis being far from the head. The shark has a back and a neck also, the shoulders not being joined to the head. But a fish is more of a fish and is better adapted for a fish's place in life, if it crowd all these things together and get them close to the head.

The caudal fins give most of the motion to a fish. The other fins are chiefly used for steering. The pectoral fins are almost constantly in motion, and they often help in breathing by starting currents outside which draw water over the gills.

The skeleton of the fish is made up of the backbone and its appendages, much as is the case with the skeleton of man. But in the fish the bones are relatively smaller, more numerous and not so firm. The front end of the vertebral column is modified as a skull, to contain the little brain which serves for all a fish's activities. The skull is usually considered as made up of a certain number of vertebræ enlarged and otherwise changed in form. This was the view of Goethe a hundred years ago, and it seems to be correct. From the skull spring the jaws, the membrane bones and the shoulder girdle. The backbone itself is made of about twenty-four pieces of vertebræ. Each of these has a rounded central part, concave on each side. Above this is a channel through which the great spinal cord or nerve passes, and besides this, a certain number of processes or projecting points. To some of these, through the medium of another set of sharp bones, the fins of the back and tail are attached. Along the sides of the body are the slender ribs.

The fish is, like any other animal, a machine to convert food into power. It devours other animals or plants, assimilates their substance, takes it over into itself, and by the waste due to its movements, uses up this substance again. The food of the Sunfish is made up of worms, insects and little fishes. To seize these, it uses its mouth and teeth. To digest them, it needs its alimentary canal, made of the stomach with its



glands, and the intestines. If we cut the fish open, we shall find the stomach, with a few long glands, called pyloric cæca, by its farther end and near the large liver with its gall bladder; on the other side is the smaller spleen. After the food is dissolved in the stomach, the nutritious part is taken up by the walls of the intestines, whence it passes into the blood.

The blood is made pure in the gills, as we have already seen. To send it to the gills, the fish has need of a little pumping engine, and this we shall find at work in the fish just as in all higher animals. This engine of stout muscle surrounding a cavity is called the heart. In most fishes it is close behind the gills. It is made of two parts only, not of four, as in man. The auricle receives the impure blood from all parts of the body. It passes it on to the ventricle, which, being thick-walled, is dark red in color. This passes the blood, by convulsive action, or heart-beating, on to the gills. From these the blood is collected in arteries, and without again returning to the heart, it flows all through the body. The blood in the fish flows sluggishly. The combustion of waste material goes on slowly, and so the blood is not made hot as it is in the higher beasts and birds. Fishes have but little blood; what there is is pale and cold and has no swift current. While a fish may be quick to move, having a strong oar on its tail, there is generally nothing else that is quick about him.

If we look about in the inside of a fish we shall find close along the lower side of the backbone, covering the great artery, the dark red kidneys. These strain out from the blood a certain class of impurities, poisons made from nerve or muscle waste, which cannot be burned away by the oxygen of the breath. There are also in the back part of the body the ovaries, which in springtime swell with the eggs from which new fishes are to be hatched.

The movements of every animal are directed by the nervous system. This is made up of a central part, with nerves of sensation which run from the outside inward to it, and nerves of motion which run outward to the muscles. In the front part of the Sunfish, just above his stomach, is a closed sac filled with air. This is called the air-bladder, or swim-bladder. It helps the fish to maintain its place in the water. Bottom fishes have it small, while fishes that rise and fall in the current generally have a large swim-bladder. The air inside of it is secreted from the blood, for the Sunfish has no way of getting any from the outside.

But the original purpose of the air-bladder was not to serve as a float. In very old-fashioned fishes, it has a tube connecting it with the throat, and, instead of being an empty sac, it is a true lung made up of many lobes and parts and lined with little blood vessels. Such fishes as the Gar-pike and the Bow-fin, gulp air from the surface of the water and breathe with their swim-bladders.

In the very little Sunfish, when he is just hatched, the air-bladder has an outside connection, which, however, is soon lost, leaving only a closed sac. From all this we know that the air-bladder is the remains of what was once a lung, or additional arrangement for breathing. As the gills

furnish breath enough, the lung of the common fish has fallen into disuse, and thrifty nature has used the parts and the space for another and a very different purpose. This will serve to give us a way of thinking about the swim-bladder, and the process by which the fish came to have it and to lose its lung. When we study the various steps in the process, we shall meet with a great many questions which no man living, and no fish, can answer.

The movements of the fish, like those of every other animal big enough to hold in one's hand, are directed by a central nervous system, of which the principal part is in the head and is known as the brain. From the eye of the fish a large nerve goes to the brain to tell the fish what is in sight. Other nerves go to the nostrils, the ears, the skin, and to every part which has any sort of capacity for feeling. These nerves carry their messages inward, and when they reach the brain, they are transformed into movement. The brain sends back messages to the muscles, directing them to contract. Their contraction moves the fins and the fish is pushed along through the water. To scare the fish, or to attract it to its food, is about the whole range of the power that sight or touch has on the animal. These sensations changed into movement, constitute what is called reflex action, that is, action performed without thinking of what is being done. With a boy, winking, dodging, yelling, and a good many other familiar actions, may be equally reflex. The boy can also do many other things "of his own accord," that is, by conscious effort. He can choose among a great many possible actions. But a fish cannot. If he is scared, he must swim away, and has no way to stop himself. If he is hungry, and most fishes are so all the time, he will spring at the bait. If he is thirsty, he will gasp, and there is nothing else for him to do. In other words, the activities of a fish are all reflex, all suggested and directed by external things.

The Sunfish, in the spawning time, will build some sort of nest of stones on the bottom of the eddy, and then, when the eggs are laid, the male, with flashing eye and fins all spread, will defend the place with a good deal of spirit. But all this, too, is reflex action. He fights as well the first time as the last. The pressure of the eggs suggests nest-building to the female. The presence of the eggs tells the male to defend them. But the facts of the nest-building and the nest protection are not very well understood, and any boy who can watch them and describe them truly will be able to add something to science.

The brain of the fish seems very small and is covered with a great deal of watery fluid, intended for its protection. If we take our dead Sunfish (for the live one we shall look after carefully, giving him every day fresh water and a fresh worm or snail or bit of beef), and cut off the skull above, we shall see the separate parts of the brain lying in pairs, side by side, in the bottom of the brain cavity. The largest pair is in the middle, two nerve masses, each called a ganglion, each ganglion round and hollow. If we turn these over, we shall see that the nerves of the eye run into them. We know, then, that these nerve masses receive the impressions



of sight, and so they are called optic lobes. In front of the optic lobes are two smaller and more oblong nerve masses. These constitute the cerebrum. This is the thinking part of the brain, and in man and in the higher animals, it makes up the greater part of it, overlapping and hiding the other ganglia.

But the fish has not much need for thinking, and its fore-brain or cerebrum is very small. In front of these are two small, slim projections, one going to each nostril. These are called the olfactory lobes and receive the sensation of smell. Behind the optic lobes is a single small lobe, not divided into two. This is the cerebellum, and it has charge of certain powers of motion. Under the cerebellum the spinal cord begins, its broad forward end being called the medulla. The rest of it is threaded through the different vertebræ back to the tail, and at every joint it sends out nerves of motion and receives nerves of sense. Everything that is done by the fish, inside or outside, receives the attention of the little branches of the great nerve cord.

Every part of the fish, and every part of every animal, is made up of minute masses of jelly-like stuff done up in little packages, all so small and so close together that we cannot, without a strong microscope, see any division. Each of these little packages is called a cell, and the wonderful substance within it is called protoplasm. Where life is, there is protoplasm, and each function or action in life involves some change in the masses of protoplasm, and in these changes, too, many things take place which no man and no fish has yet learned to understand.

One of the things that every animal and every plant should do is to provide for the generation that comes after. It should leave descendants, that the earth, which is fitted for life and to which life is so perfectly fitted, should not be left barren and desolate.

The Sunfish provides for this by leaving each year myriads of eggs, each of which has the promise and power to grow up into a little Sunfish.

Each egg is a simple cell of protoplasm, much like the other cells, but prepared to be cut loose and to grow up by itself. To make a perfect cell, a male and a female cell must be joined. Each female cell, or egg, is provided with a thin shell and a mass of oily substance or yolk. This yolk makes the egg large enough for us to see it with the naked eye, and as the little fish grows, it serves as his first food. The true egg or egg cell is a microscopic part of what we call the egg. The eggs are laid on the bottom of the stream and the male cells, which are very small and carry no yolk, are cast off into the water, each one to swim until it finds its mate.

When the new cell is made by the joining of the two, it begins at once to grow, and soon it is so large that it divides into two. Then each of these grows and divides, so that we have instead of one cell a little mass of cells. To make the increased mass, first two, then four, then eight, then sixteen, then thirty-two, the food yolk is used up. The cells form a hollow ball of cells. Then one side is pushed in, and from the pushed-in cells

develop the stomach and internal organs, while the cells begin to group themselves together for a beginning of brain, head, eyes, and fins. After a while the yolk is all used up, the egg-shell bursts, and the little fish goes out into the world to shift for himself. Often he is swallowed by some larger fish before he has been out an hour, but of the millions set free each year, some survive, else the brook would lose all its fishes and the seas all theirs, and the small boy would lose one of the best of all aids to his education.

The Sunfish that I have written about, with the black and scarlet ear, is the one most common in all the streams from Minnesota across to Maine, and then down the seaboard to South Carolina. But it is only one of thirty kinds of Sunfish. In some regions the common Sunfish is a duller green, or a blue or coppery red, and when it grows up, the ear-flap is all black and there are inky-black spots on the last rays of the dorsal fin. This is the Blue-Gill or Dollardee, *Lepomis pallidus*, and it can be found throughout the Mississippi Valley. In the same region are Sunfishes with very long ear-flaps, and a body splashed with scarlet, *Lepomis megalotis*, and blue, even more brilliant than our little "Pumpkin Seed," of New England. This is the long-eared Sunfish, and every boy in Ohio and Kentucky knows it. In the basins of the Columbia and Colorado rivers and of the Great Salt Lake, there are no Sunfishes at all, but in the Sacramento River we find a single one, *Archoplites interruptus*, dull green in color and called by the boys a perch. If any boy read this he should go to his brook and find out how many kinds of Sunfish there are, examine their color, their teeth, their fin-rays, gill-rakers and scales and see how he can tell them apart.

In the brook, the boy will find other fishes—suckers, chubs, lampreys, eels, minnows, perch, pickerel, catfish, trout, miller's thumbs—and maybe other things, or perhaps, most interesting of all, the little Johnny Darters. These queer little fish lie flat on the bottom, never moving for hours at a time, then, when they are touched, springing like a flash and coming to rest a foot or two away, their tails curled around a stone, as quiet as though nothing had ever happened. Some of them are most brilliantly colored, crimson, blue, green, orange, in dashes or bars or spots. These are the greatest treasures of the naturalist who studies the fresh-water fishes, and to learn to know and love the darters of your brook is the very poetry of angling.

The sea, too, is full of fishes, each with its own ways and its own machinery for living, swimming, eating, and keeping up its kind. There is no space here to tell of all, nor of any, of these fishes and their ways. They are the study of a lifetime, and the more you know of them the more you find worth knowing. The great angler of the brooks of Stafford once said, "It is good luck to any man to be on the good side of the man who knows fish." It is still better luck to know the fish yourself.





## THE SWORDFISH

THE Swordfish is so called because his upper jaw is lengthened into a long, sharp blade, like a sword, half as long as his body. This fish is found in the waters of the Atlantic coast, from Nova Scotia to the West Indies, and in the Mediterranean, and off the western coast of Europe. The French call him "Emperor," because he carries a sword.

The Swordfish feeds on menhaden, mackerel, and squids, and migrates north and south in search of food. In northern waters, he appears in May or June and remains until the fall months. When the Swordfish finds a school of mackerel or menhaden, he sinks below them, and then rising, strikes among them with his sword. In this way he kills many fish, which he eats at his leisure.

Swordfish taken in our waters are rarely found to have spawn, and little is known of their breeding habits.

Swordfish, fully developed, are from seven to fifteen feet long, and weigh as much as six hundred pounds. They are solitary fish and, except at the breeding season, are not seen in pairs, and never in large schools. The Swordfish rises to the surface only when the day is fair and the sea smooth. Then he swims along, so close to the surface that his back and tail fins project from the water. It is by this sign that the Swordfish hunter detects his game.

The chase of the Swordfish is not without excitement. It is useless to pursue the fish in a small boat, for at its approach he quickly takes alarm and speeds away. So he is followed in a small sailing-vessel, and from this he does not attempt to escape. In the bow of the vessel stands the harpooner, and when the vessel draws near enough, he drives the harpoon into the fish's back. The frightened and wounded fish darts forward at great speed, but the iron head of the harpoon, which is loosened from the shaft when the blow is struck, remains firmly fixed in his back, and to this iron head is attached a rope. The rope is paid out rapidly, as the Swordfish dashes through the water at racing speed.

Meanwhile, the rope is passed into a small boat alongside, and now the real excitement begins. The rope tightens and the small boat is drawn through the water with her nose dipping under the waves, so great is the speed. But soon the Swordfish tires. Then



the slack rope is hauled in and the fishermen endeavor to draw the boat alongside the fish, and to kill him with a lance thrust in the side, as whales are killed.

The Swordfish, always a dangerous foe, may become doubly so now that he is wounded. He sometimes turns upon the boat and drives his sharp sword through the oak planks, as if they were paper, but with his sword fast in the wood, he is unable to withdraw, and is soon killed. Swordfish sometimes overturn a boat, and if one of the fishermen is so unfortunate as to be attacked in the water, he may lose his life almost immediately.

Swordfish are nervous and strange in their actions. They often leap clear of the water, without apparent cause. Ordinarily they swim slowly, but when excited, they can swim very fast. They easily keep pace with a ship, and as any large object moving through the water seems to be regarded by the Swordfish as an enemy, he sometimes drives his sword through the planking of the ship, making a hole which may admit enough water to sink the ship. But in this act he loses his sword, which he cannot withdraw from the plank. In the same way, Swordfish have been known to attack and kill sharks and whales.

The flesh of the Swordfish is oily, but very rich, and is always in demand for the table. It is usually cut crosswise of the body, in steaks, and broiled.

The Spearfish, the Sailfish, and the Cutlass fish, are smaller species of the same family, and all have swords, ranging from a few inches to two feet in length.

## THE FLYING-FISH

THERE are several birds which are well-fitted for swimming and diving under water, but there is only one family of fishes that can make any pretense at flying through the air, and even these do not have the power of sustained flight, like that of a bird.

The "Flying-fishes" are very interesting. They are found in the open seas of tropical regions, and there are many species, which vary from three to twenty inches in length. Their ability to remain in the air for several moments is due to their long side fins, which are almost like wings. These fins do not, however, impart motion. That comes from the vibration of the fish's tail, before he leaves the water, and the long side fins simply serve to keep him afloat in the air, as a parachute sustains a man.

As a rule, Flying-fishes do not rise more than a few feet above the surface of the sea, and, after flying about two hundred yards,

they descend to the water, where another wriggle of the tail enables them to mount in the air again, if they wish to do so. They do this many times in succession, and as they always travel in companies of from twenty to a hundred or more, it is a very pretty sight to see them rise and dip. While in the air, they are often attacked by sea-birds, and they are pursued by dolphins, which leap from the water in pursuit of them, making the spectacle even more interesting.

Flying-fishes have fallen on the deck of a ship which chanced to cross their path while they were moving through the air. Their beautiful colors are much admired. Their flesh is excellent, and in the South Sea Islands the natives catch them in nets.

Perhaps you wonder why these fishes should wish to jump from the water. Many other people have wondered at that very thing. Some students of fishes think that they rise to escape other fishes which are pursuing them; and others claim that it is only the Flying-fish's favorite method of amusing himself.

## THE HALIBUT AND OTHER FLAT FISH

THE Halibut looks something like a fish that has been passed through a clothes-wringer, for he is as flat as your hand. Both his eyes are on the right side of his head, and a long fin extends the entire length of his back, and another long one underneath his body. In mid-water the Halibut swims "on edge," and very uncanny he looks. He often settles to the bottom, however, and lies flat on his white side, while the dusky side remains uppermost. It looks like the sand of the bottom, and conceals his presence from his enemies or his prey. His eyes protrude from his head, and altogether he is a queer-looking fish.

But odd as he looks, his flesh is excellent. When men go fishing, they nearly always hope to catch the largest of the kind they wish for, but when they go for Halibut, they hope to catch the smallest, for the flesh of a small Halibut is finer than that of a large one. But the smaller ones are rarely caught. The large ones weigh from a hundred and fifty to three hundred pounds, and their flesh is not so well-flavored as that of the little Halibut of fifteen or twenty pounds' weight, which are called "Chicken Halibut." Another remarkable thing is that the fully-grown male Halibut weighs fifty pounds, while the female of corresponding age weighs several times as much. A fat female fish weighing eighty pounds is considered to yield the choicest meat.



The Halibut is, you see, a very large fish. Only the swordfish, the tunny, and the tarpon, are larger, among the fish of our Atlantic coast waters. Halibut are found only in cold waters, and are rarely caught south of New York. In the Pacific Ocean they are sometimes caught as far south as San Francisco.

The Halibut has a large mouth and must find a large amount of food to fill his correspondingly large stomach. He sinks to the bottom and lies in wait for crabs and mollusks which may be so unlucky as to come near him. His big mouth snaps, and they disappear from view. He also pursues cod, haddock, menhaden, mackerel, lobsters, and, in fact, almost anything that is edible.

Some fishermen say that Halibut spawn in the summer and others say in the winter. The roe of a large female Halibut has been found to contain several millions, not thousands, of eggs. It is not positively known whether the spawn rests on the bottom or floats, nor how long it takes for the young Halibut to appear.

Whales and sharks are almost the only sea-animals large enough to prey upon the Halibut, but they regard him as a tidbit, and if you have eaten Halibut, you will agree with them that the flesh is delicious.

The Halibut uses his tail for striking other fish and often kills them in that way more easily than he could with his mouth, which, though it has a wide gape, is narrow.

The Plaice, or Summer Flounder, is a flat fish, similar in most respects to the Halibut, but smaller. The largest specimens weigh about twenty pounds, while the average weight is six or seven. This fish is found all along the Atlantic and Gulf coasts, as far north as Cape Cod. An eight-pound Plaice is about twenty-seven inches in length.

The Flatfish, or Common Flounder, is another member of the family, smaller than the Plaice. The largest specimens weigh a pound and a half and measure fifteen inches in length. The fish has a small mouth and, as he can attack and capture but few other fish, he spends most of his time on the bottom, where he wriggles his way into the sand and lies in ambush for crabs or shellfish. The Flounder spawns in spring, in shallow water. His flesh is white, firm, and good to eat, but the appearance of the fish is so ugly and grewsome, that many people are prejudiced against him as a food fish. Nevertheless, a good many flounders are eaten, for they are easily taken and are very abundant.

The Turbot and the Sole, which are flatfish similar to those already described, have been famous as food fishes, in Europe, for centuries. The Turbot sometimes weighs nearly two hundred pounds, but a female which weighed only twenty pounds has been known to deposit fourteen million eggs!

The various flatfishes are among the most remarkable of our finny friends, but in nothing more than in the fact that when born they are symmetrical fishes; that is, they have one eye on either side of the head and their bodies are much like those of other fishes. But one of the eyes will not look downward, and that side of the skull soon begins to turn upward. Soon the inclined side has turned half-way round, both eyes are on one side, the fish can see in only one direction and is a true Flatfish for the rest of his life.

### THE MACKEREL

THE Mackerel is a beautiful fish, in both form and color. His body is shaped like a flattened cigar, pointed at both ends. It tapers until it is very narrow near the tail, which is deeply forked. With his arrow-like body, the Mackerel can dart through the water at great speed. His beautiful coat—made up of scales so tiny that we do not realize that they are scales unless we examine them with a microscope—is blue, marked with many bars of black on the back, and silvery on the sides. You have heard people speak of a “mackerel sky,” when the clouds are separated into little strips which show the blue between. It is very much like the marking of the Mackerel’s back.

The common Mackerel is a fish of the North Atlantic. He likes cold water and rarely goes south of Cape Hatteras. In summer, Mackerel appear in great numbers off the coast of the middle Atlantic and New England states, and as far north as the Gulf of St. Lawrence. They are wandering fish and roam from one locality to another. In some years the number seen is comparatively small, but the following season they may appear in millions. They travel in large schools, and are inclined to swim near the surface. Sailors and fishermen see them in a mass, with a front many miles wide, their blue backs darkening the water farther than the eye can see.

Mackerel spawn in deep water and their eggs are very minute. A fish weighing only a pound and a quarter will yield half a million eggs. The fry are tiny things, not more than an eighth of an inch long when born. The full-grown Mackerel may attain a length of seventeen or eighteen inches, but the average is twelve or thirteen inches, with a weight of from twelve ounces to a pound.

The Mackerel feeds largely on crabs, shrimps, the spawn of lobsters and fish, jellyfishes and young fishes of various kinds. The large Mackerel is sometimes a cannibal and eats his smaller relatives. Probably no fish has more enemies, for the gannets, terns and other sea-birds take advantage of his habit of swimming at the surface to



seize him as prey; and in his native element, whales, sharks, dogfish, bluefish and cod, all devour Mackerel with a relish.

As a food fish, the Mackerel has long ranked next to the cod in importance and the Mackerel-fishery is a largely-followed industry in New England. The fish are caught in seines, split open, dried and salted, and so prepared, form a staple article of commerce. Fresh Mackerel has a delicate and appetizing flavor, and differs from many other species of fish in being made up of both white and dark meat.

The Spanish Mackerel has spotted sides, and is not barred, like the common Mackerel. The early settlers of this country called him the "Spanish Mackerel" because he had spots like a fish which bears that name in the waters of Europe. The Spanish Mackerel ranges from Cape Cod to the Gulf of Mexico, but is most plentiful in the southern waters of his range, for he prefers warm temperatures. In most of his habits and characteristics he is like the common Mackerel.

## THE BLUEFISH

THE Bluefish is one of the most important food fishes of the Atlantic coast, and the value of the annual catch is rarely less than half a million dollars. The flesh is very sweet and firm, and may be cooked in several ways—broiled, baked or boiled, to make a most appetizing dish for the table. This fish is good only when fresh, however, and it is only those who live near the coast and have the opportunity of eating it soon after it comes from the water, that know the Bluefish at its best.

The Bluefish is a sea-fish, although schools are sometimes found in the lower course of a large tidal river, or in inlets of the sea. He ranges north and south, from Brazil to Nova Scotia, and appears in the Gulf of Mexico. He is not found on the western coast of Europe, but is plentiful in the Mediterranean Sea and in East Indian waters. Bluefish are migratory and travel great distances to reach new feeding grounds. They move in schools, numbering countless thousands, perhaps millions, and, during the summer months, appear in great numbers off the coast of New Jersey and New England, especially in the waters about Cape Cod.

The Bluefish is savage and piratical. His mouth is armed with very sharp, powerful teeth, and, when caught, he must be handled carefully or he may inflict a serious wound on his captor's hand. This wolfish swimmer feeds altogether upon other fish, and is a glutton of the most greedy kind. The menhaden, which also travel in schools, are his favorite food, and he likes mackerel almost as well.

Bluefish eat ravenously and gorge themselves on all occasions. They do not confine their diet to smaller fishes, but attack those which are larger than themselves, and if the prey is too large to be swallowed whole, they bite the fish in two and eat only the rear half. Where a school of Bluefish passes through the sea, the water is often seen to be stained with the blood of their victims. At one time they threatened to destroy the mackerel fishery of New England.

Little is known of the spawning habits of the Bluefish except that the spawning season is thought to be in July and August. The fish does not attain full growth until the second or third year.

Bluefish are captured in nets and pounds, by those who pursue Bluefishing as a business, but trolling for Bluefish is a favorite sport for anglers. The fish bite well and fight hard, and summer residents along the coast of New Jersey and New England find Bluefishing an exciting pastime.

## THE SKATE

THE Skates, or Rays, are among the most popular fishes we find in the ocean, and some of them are not very pleasant creatures to encounter. The Rays are closely related to the sharks, which they resemble in their ferocious disposition.

The fish of this family are broad and flat, with their mouths underneath, and their side fins stretching out into wing-like flaps. Some have long, slender tails; in others the tail is short. The most common species on our eastern coast is about two feet long, but the "Barn-door Skate," which is the largest found in North Atlantic waters, measures twice that length. These fish spend most of the time at the bottom. They feed on fish, shellfish, crabs and the like. When swimming, they move their wing-like fins, so that their motions are something like those of a bird in flight.

The Torpedo is a Ray that may be called a living electric battery. He has an arrangement of cells like honeycomb, just under the skin on the forward part of his body, and from the nerves and muscles in these cells he can produce a genuine electric shock, strong enough to kill fish with which he comes in contact. This is his method of disabling his prey. A bather might receive a shock from the Torpedo that would disable him for a time.

The Sting Ray has a series of spines attached to his tail, and with these spines he can inflict a severe wound.

The Eagle-ray and Sea-devil are very broad and grow to enormous proportions. A Sea-devil was captured in West Indian waters which measured fifteen feet across, was four feet thick and weighed more



than half a ton. These fish bring forth their young alive, instead of depositing eggs on the sand. When accompanied by their offspring, they are very fierce and will attack a boat without hesitation. The pearl-divers dread this fish more than they do the shark, for the Sea-devil sometimes settles down upon them and folds his body about their heads, so that there is no possibility of escape.

The Saw-fish is one of the fiercest and most dangerous of the Ray family. This fish has a body something like that of the shark, and his snout is lengthened into a long blade, armed with sharp teeth on both sides. This "Saw," for that is a fairly good designation of it, is sometimes twelve inches broad and six feet long, and has from twenty-five to twenty-eight pairs of teeth. You can readily see that it is a terrible weapon. The Saw-fish does not hesitate to attack any creature of the ocean, and with the sharp teeth of the saw tears off pieces of flesh which he then seizes in his mouth. The mouth is located on the under side of the head, like the shark's. The Saw-fish is more than a match for the mighty whale, and the latter is often killed by the smaller but better-armed fish.

The flesh of the common Ray or Skate which we find on our northern coasts is palatable; but the fisherman who finds a Skate on his hook is usually angry at the fish for stealing his bait, and throws him back into the water. In Europe, the Skate is considered an excellent article of food, but as there are so many nicer fish in this country, they are very rarely eaten here.

Some Rays lay eggs which resemble those of the shark, but most of the species bring forth their young alive.

## THE SHARK

THE Shark, on account of his fierceness, is often called the pirate among fishes and the monster of the deep. The sailor shudders at the mention of his name, and many a man has lost his life in the jaws of this cunning, powerful and bloodthirsty fish.

The Shark's body is long and cylindrical, and his skin is covered with small spines, which make it rough, almost like sandpaper. He has great strength in his fins and tail, and with them can knock a man from his seat in a boat, or even crush the boat. The Shark's mouth is on the under side of his head, and he is compelled to turn on his side or back when he seizes his prey. If it were not for this, his victims would be even more numerous than they are; but in the second or two that he must take to turn on his side before he can bite, they sometimes get away.

The Shark's mouth is armed with triangular-shaped teeth, arranged in semi-circular rows. There are several rows of these sharp and terrible teeth, which point inward, but only the front row is used at one time. The others lie flat in the Shark's mouth, until the teeth of the front row are broken, then the teeth of the second row rise and take their place.

Sharks are most abundant in warm waters, but are found in temperate seas as well, all over the world; and one or two species appear in arctic waters. They do not usually leave salt water, but when a Shark follows a ship for weeks, as he sometimes does, he continues his pursuit into the brackish water of a river before he abandons the chase.

The White Shark, the largest of the species, is often thirty or forty feet long. He is the typical "man-eater" Shark, and the most dreaded fish that swims the ocean. He will follow a ship through the open seas for weeks, greedily devouring the refuse thrown overboard and waiting patiently, with the hope that some human being will fall from the ship into the sea,—for this great Shark is very fond of human flesh. He can bite a man in two with one snap of his mighty jaws, and has been known to throw himself across a boat in his fierce greed.

The Mackerel Shark, which reaches a length of ten feet, is so called because he preys on the mackerel and other fish, and for this reason is cordially hated by the fishermen.

One of the most remarkable species is the Hammer-headed Shark. The Hammer-head is about fifteen feet long, and his head expands into two lobes. In the end of each lobe is an eye. As the head is uniform in size on both sides, it is really more like the head of a mallet than that of a hammer.

The Thresher Shark, which reaches fifteen feet in length, has a remarkable, upward-curving tail, which constitutes about half his entire length. With this tail he threshes the water and so frightens the fish on whom he seeks to make a meal. They huddle together, while the Thresher Shark swims around them, choosing a fish here and there, as he passes.

The Dogfish is a small Shark, from one to three feet long and about fifteen pounds in weight. This fish is as fierce as other Sharks, in proportion to his size, and does a great deal of damage to the fishermen's nets by biting the meshes with his sharp teeth, in order to get at the fish which have been caught in the net. Off the New England coast, the Dogfish are caught in great numbers, and from their livers an oil is made. A thousand Dogfish livers will make a barrel of oil.

Shark's fins are used for making gelatin, more largely in China, perhaps, than anywhere else; but, except for the gelatin and the oil obtained from the liver of the Dogfish and some other species, the Shark



is of little value. The rough skin, known as "shagreen," is sometimes used for polishing wood, or for covering sword-grips. The flesh is not palatable, although savages eat it. The damage that the Shark does by killing other fish more than offsets the small good we get from him, and, as no year passes when he does not take a considerable number of lives, we are justified in regarding him as a pirate, to be hunted down and killed wherever found.

Sharks do not spawn like other fish, and all fishermen will tell you they are glad a Shark cannot lay a hundred thousand eggs, as a shad does. Think how the ocean would swarm with these dreadful monsters, if such were the case! Some species of the Shark lay eggs, usually two at a time. They are square or oblong in shape and covered with a case like leather. At each corner of the egg-case is a little string, with which the egg becomes tangled among the seaweed and so cannot drift into too deep water. When matured, the young Shark breaks out of this case and feeds on a sac full of yolk, which is attached to the under part of his body, until he is old enough to find and eat live food. You may, perhaps, have seen the dark-colored, square, leather-like egg-cases tangled in the seaweed cast up on the beach. All Sharks do not lay eggs which are deposited among the weeds, in this way. Some species retain their eggs within their bodies, and the eggs mature and the young Sharks are born in a chamber which nature has provided for the purpose. They do not leave this chamber in the parent Shark's body until they are able to look out for themselves.

The large Shark is generally killed with the harpoon; sometimes, however, he is caught on a great hook at the end of a chain. The hook is baited with meat and the Shark swallows it greedily. He is drawn to the side or deck of the ship and dispatched with an ax. There are natives in the South Seas who are bold enough to risk their lives by venturing into the water to kill a Shark. When he rushes upon the man whom he intends to bite in two, the latter must choose to a nicety the moment when the Shark turns on his side, and drive a knife into the great fish. It is a dangerous business for the Shark-slayer.

Sharks are generally gray or grayish brown above, and white underneath. There is, however, the Blue Shark, which has a blue back, and the Tiger Shark, or Zebra Shark, of the Indian Ocean, which is a brownish yellow, barred with black.

Sharks usually hunt each for himself; but the Dogfish travel in schools, and, in tropical waters, a school of Sharks sometimes appears in pursuit of a boat, which contains a possible dinner in the shape of a man.

## THE DRUM

THE Drum is one of the few fishes that make a characteristic noise with the throat. The name "Drum" is applied to several species of fish, all of which, however, have in common the ability to produce sounds resembling the rolling or rumbling of a drum. It is supposed that the noise is made by a contraction of the fish's air-bladder, although some people think it is made by the rubbing together of bones in the throat. As the noise is most often heard during the mating season, it is thought that the fishes use it to call to their mates. Sometimes the term "Croaker" or "Grunter" is applied to the Drum.

The Sea Drum is a good-sized fish and weighs twenty or thirty pounds. A full-grown Drum sometimes weighs eighty pounds. From his lower jaw hang little barbels, or feelers, so that he looks as if he had a chin whisker. The young Drum has four or five dark, vertical bands across his silvery coat; but when he gets to be an old fish, he has a uniform dark color.

The Drum is a bottom-feeder and his barbels are to help him in feeling his way over muddy places. He has very strong, flat and powerful jaws, so that he can easily crush an oyster shell. If you try to break an oyster shell with your hands, you will find that you need a hammer. But the Drum can break it with his jaws, so you can see how strong they are. He is fond of clams, mussels and scallops, as well as oysters. Oyster-growers complain of the mischief done by this fish on their oyster-beds, for he sometimes tears from the bottom and crushes more oysters than he can eat, apparently because it amuses him.

When the breeding season is near, in the spring, the male fish "drums" very loudly. The female also drums, but less noisily. The eggs are as large as shot, and dark brown in color. They sink to the bottom and mature there. The flesh of the Drum is coarse, and is often filled with worms, so that this fish does not take high rank among the food-fishes.

The Red Drum, which is also called the Beardless Drum, because he has no feelers on his lower jaw, or the Branded Drum, because he has a peculiar spot on his tail, is a favorite fish in southern waters. The flesh is not always red, as his name indicates, although it usually has at least a faint tinge of pink.

The Red Drum is a game fish and will give a fisherman a lively battle before he is landed, for he ranges in weight from twenty to forty pounds, and is often four or five feet long. He does not feed



exclusively on the bottom, like the Sea Drum, but resembles that fish in most of his habits. This fish is taken in gill-nets, and is considered good food.

The fresh-water Drum, which is called "Sheepshead" in the Great Lake region, and "Croaker" in Indiana, grows to a length of four feet and weighs forty or fifty pounds. He is found only in the larger lakes and streams and, as the flesh is coarse and tough, it does not rank high as food. Shellfish, crabs and shrimps are the chief food of this fish, although he devours other fishes at times.

### THE PIPE-FISH AND THE SEA-HORSE

THE Pipe-fish has a very slender body and his jaws are united, so as to form a long tube, through which he takes his food. He is found in all seas and varies in length from three or four to twelve inches.

The Pipe-fish lives in the eel-grass, that grows along shore, and feeds on such tiny sea creatures as he can capture with his tube-like snout. But the most interesting fact about this fish relates to the young. The female lays her eggs and then the male places them in a pouch under his tail. There the eggs are hatched, and the young fry remain inside the parent's pouch for some time. If you take a Pipe-fish and shake the fry from his pouch and then put him back in the water, the fry will immediately hasten to get into the pouch again. Only the male fish has this pouch, and he looks after the young fish, without help from the female. This provision for carrying his young gives the Pipe-fish the same place among fishes that the kangaroo and the opossum, both of which are pouched animals, have among the quadrupeds.

One of the oddest of the little creatures of the sea is the Hippocampus, or Sea-horse. In the mythology of the ancient Greeks, the steed of Neptune, god of the ocean, was the Hippocampus—a fish with a horse's head. So that name was given this little creature, which is only about six inches long, because he presented the appearance of a horse's head on a fish's body. He has a tube-like snout, like the Pipe-fish, and his body is covered with hard plates. His tail curves and twists very easily, and the Sea-horse uses it for clinging to weeds or other things. He always maintains an upright position in the water, which makes him look very much like the knight on a chessboard. Most fishes have fixed eyes, but the Sea-horse can move one eye in one direction at the same time that he moves the other in the opposite direction.

The Sea-horse does not swim about like other fishes, but clings to a weed by his tail and sucks into his tube-like mouth water-insects and tiny sea creatures that come his way. He takes care of the young Sea-horse in the way that the Pipe-fish takes care of his young, by carrying them in a pouch under his tail. He is usually found in the eel-grass, near the shore.

In Australian waters there is a Sea-horse provided with long strips of skin-like formation, which look like weeds as they float in the water, and serve to hide the Hippocampus from his enemies, and also from the insects and other creatures on which he feeds.

### THE REMORA AND THE LUMP-FISH.

THE Remora is a remarkable fish, found chiefly in tropical waters. He has on the upper part of his head a disk, so made that with it he can attach himself to any object by such powerful suction that he cannot be removed until he chooses. The Remora often attaches himself to the under side of whales, sharks, and sword-fishes, and in this way is carried through the water without having the trouble of swimming for himself. When he sees food that he thinks will suit his taste, he lets go his hold, secures the food, and then returns again to his place under the large fish.

The Common Remora is about eight inches long, but other species grow to be much larger. The natives of the West Indies formerly employed the Remora to catch fish for them. They fastened a cord to the Remora's tail and then put him in the sea to seek a fish, to which he made fast by means of his sucking disk. Then they drew the Remora into the boat, and along with him the fish he had caught, which could not get away, no matter how hard he struggled. Columbus found the natives of Cuba using the Remora in this way, when he first visited that island; and even now this remarkable fish is used by the natives of Zanzibar, a large island off the east coast of Africa, to catch turtles.

The Remora is easily tamed and will allow his owner to handle him without attempting to escape. When not in use, he is kept in a canoe full of water, and well fed. To catch a turtle, the owner of the Remora, who has his fish secured by means of a cord fastened to a ring in his tail, puts his fish into water where turtles are likely to be found, and the Remora fastens to the under shell of the turtle with his sucking-disk. The two are then pulled ashore; the Remora releases his hold on the captured turtle and is ready to go for another.



The Lump-Fish, Lump-Sucker or Sea-Owl, for all these names are applied to the same fish, is short and "lumpy." His skin is covered with spiny tubercles, and the under fins grow together so as to make a sort of sucking disk, much like that which the Remora has on the top of his head. The Lump-Fish can hold to other objects with a powerful suction, by means of this disk. Most of his time he spends on the bottom of the sea, for he is a poor swimmer. He feeds chiefly on smaller fish that come near the place where he lies in wait for them. In May and June, the Lump-Fish seeks shallow water in which to spawn. The male makes a pit in the sand and surrounds it with stones. In this nest the female deposits her eggs, which number several hundred thousand. The male fish remains near the nest and watches over the eggs and the fry, when they are hatched.

The Lump-Fish varies in length from eighteen inches to two feet. He is an awkward-looking and slow-moving fish, but his colors are very beautiful, and include various tints of orange, purple, and blue.

## THE DOLPHIN

THE Dolphin belongs to the same order as the whale. The true Dolphin is a mammal, and the so-called Dolphin, which exhibits wonderful changes of color in dying, is a fish. How the latter came to receive the true Dolphin's name it is hard to say; it may have been given to him because both are fond of leaping from the water and playing upon the surface.

The Dolphin is classed among the whales that have teeth, and he is better provided with teeth than the great sperm whale, for where the latter has teeth only on the lower jaw, the Dolphin has both upper and lower teeth. His snout tapers to a somewhat pointed beak, and the fin on his back is large and conspicuous. In both these features he differs from the true whales. The Dolphin has a single blowhole, and spouts vapor and water, as other whales do.

There are several kinds of Dolphins. Most of them live in the ocean, but there are some that live in the lower courses of great rivers, such as the Amazon in South America and the Ganges in India. The common Dolphin is most abundant in the Mediterranean Sea and the Atlantic Ocean. He is commonly over six feet long. His color is black on the back, gray on the sides, and white underneath. His body tapers toward the tail, which is broad and flat and shaped like a crescent.

Dolphins live in companies, or shoals, as they are called, and are very playful creatures. When they catch sight of a ship, they draw









near and seem to delight in performing their best tricks, as though for the pleasure of those who are looking on. They leap out of the water and display their bodies in graceful curves; again they race along beside the ship, just below the surface of the water, which their thin back fins cut as a knife might do; then they dive and rise, blowing and spouting, and leap over each other with many graceful motions.

The Dolphin is a greedy feeder, and not only eats the fishes and smaller sea animals, but is said to attack the weak members of his own family. The young are brought forth alive and suckled by the mother, as in the case of land mammals.

The Bottle-nosed Dolphin gets his name from the fact that his snout is rounded into something like the form of a bottle.

The Dolphin's fat yields oil similar to that obtained from the large whale, but there is less of it and the creature is not easily caught, so Dolphin-hunting has never been a serious pursuit.

The large head and brain of this animal gave him a reputation for wisdom, among the ancients, and they treated the Dolphin as a sacred fish. He was supposed to confer great benefits on mankind. He was the favorite of Apollo, whose oracle at Delphi was named for this animal. Representations of the Dolphin appear on old seals or coins of the Greeks and Romans. The early French princes also used the same emblem on their coats-of-arms, and from the name Dolphin came the name of the province of Dauphiné. From that, in time, came the title of Dauphin, which was given to the heir apparent to the French throne.

## THE COD

"THE exquisite flavor of Codfish, salted, made into balls, and eaten of a Sunday morning!" That is the way so eminent a statesman as Senator George F. Hoar, of Massachusetts, pays tribute to the excellence of the Codfish. In New England, "codfish balls" are a favorite dish for Sunday morning breakfast.

The Cod is one of the most important of our food-fishes and the business of catching and salting Cod, and of making oil from their livers, furnishes employment to many thousands of people, not only in the United States, but in Europe, also.

Many years ago, the people of Massachusetts, who were largely engaged in the Cod-fishery, hung a wooden Codfish in the hall of their House of Representatives, as a token of the importance of this fish to the state; and the wooden fish still occupies this place of honor in the state-house.



The Cod is a cold-water fish and is found in the North Atlantic, North Pacific, and Arctic, oceans. He migrates, not North and South, but to and from shore, seeking water of a favorable temperature. The Grand Banks of Newfoundland have been famous for many years as the favorite home of the Cod, and in those cheerless, foggy regions many fishermen have lost their ships and their lives.

Codfish sometimes weigh as much as one hundred pounds, but specimens of that size are rare. Ordinarily they vary from two to ten pounds. A Cod weighing twenty pounds measures about three feet in length. The color of the Cod varies much according to the food he eats; it may be brownish, greenish, or reddish. The Cod has three fins on his back and two underneath, and from his lower jaw hangs one little barbel or feeler, like those of the horned-pout.

The Cod is a voracious fish, and eats not only other fishes, but all kinds of shellfish, lobsters, and clams, and he has been known to rise to the surface and seize ducks. He seems to have much the same kind of appetite as the ostrich, for such things as scissors, oil-cans, corn-cobs, and other hard substances, have been found in his stomach. Stones have also been found in the Cod's stomach, and from this fact the old fishermen used to say that the Cod "took in ballast" and sought deeper water when a storm was brewing; it is probable, however, that the stones were swallowed because sea-anemones or other food which the Cod likes was fastened to them. Some Cod feed almost entirely at the bottom, while others swim higher, but they are not a surface-swimming fish, like the mackerel.

The spawning time of the Cod is from September to November. This fish does not make a nest, or attach the spawn to a rock; it does not even seek shoal water, but spawns in deep water and allows the eggs to float where they may. The eggs are very small, and from a fish weighing seventy-five pounds more than nine million eggs have been taken.

Cod are always caught with hook and line, and are never netted. The trawl, so arranged that the baited hook lies on the bottom, is used to catch the bottom feeders; and the hand line, where the hook hangs free in the water, for the higher swimming fish. One man has been known to catch five hundred Cod in a day. Off the Grand Banks it is cold, dangerous work. If you want to read a vivid description of Cod-fishing, as it really is, you should get Rudyard Kipling's "Captains Courageous," which tells the story in fascinating style.

The flesh of the Cod is delicious, when eaten fresh, but the most of those caught are dried and salted, in which form the Cod becomes an important article of commerce. The great increase in the use of Cod-liver oil as a medicine has added to the importance of the cod-

fishery. Cod-liver oil is known to be one of the most valuable medicines for building up muscle and tissue and giving new strength to the body. The "sound" or swimming-bladder of the Cod is used for making isinglass. So we see that this fish is one of the most useful we have. Closely related to the Cod are the Pollock, the Haddock and the Hake.

The Pollock, unlike the Cod, swims near the surface of the water. He preys on the young Cod, in preference to any other kind of fish. In his structure and most of his habits, he resembles the Cod. The Pollock's liver is larger than that of the Cod, and the oil obtained from it is sold as Cod-liver oil, or mixed with the true Cod-oil. The eggs of the Pollock are large and are salted and sold as caviar.

The Haddock, another relative of the Cod, has two black spots, one on either side of his body, and the fishermen used to say that they are the thumb-and-finger marks of Saint Peter, who took the tribute money out of the mouth of a fish of this species. But it is to be feared that this is only a "fisherman's story," for there is no fish like the Haddock in the sea of Galilee, where Peter followed the calling of a fisherman. The Haddock is not so active and powerful a fish as the Cod; in size he averages from three to five pounds. The Haddock spawns in the spring, on rocky bottoms. His food is much like that of the Cod; he is especially fond of clams, and greedily devours the spawn of other fishes. The flesh of the Haddock is almost as good as that of the Cod. Many people like the one as well as the other; and as it keeps well on ice, fresh Haddock is sold in the fish markets of all the large cities, and it is safe to say that it furnishes the basis for nine out of every ten so-called "Codfish Chowders." Do you know what "Finnan Haddie" is? You will guess from the latter part of the name that it has something to do with the Haddock. It is, in fact, simply Haddock smoked and cured by the method first used at the little town of Findon, in Scotland. From "Findon Haddock" the name has come to be "Finnan Haddie."

The Hake is a fish much like the Cod, and is split, dried and salted in the same way. It is often substituted for the real Cod in the "boneless codfish" sold by the grocer; for, with the bones removed, it is hard to tell Hake from Cod. The "sounds" of Hake are used in making isinglass, and the catching of this fish has become an industry of some importance, especially since there have been so many "bad years" in the Cod-fishery, when the Cod have appeared in such small numbers as to cause great suffering among the poor people who gain a livelihood by fishing for them "off shore," from Massachusetts to New Brunswick. To these people the Hake has often been a welcome visitor, in place of the Cod.



## THE ANGLER

THE Angler, which is also called the Goose-fish, or the Fishing-frog, is an odd specimen of the fish family. He is a shore fish and usually lives at the bottom, among the weeds and rocks. His body is almost round, with a tapering tail; in fact, he is shaped something like a tadpole, only he is much larger, sometimes as much as five feet in length.

The Angler has a "hummocky" appearance; that is, the upper part of his body is irregular in outline, and as he lies on the bottom, he might very well be mistaken for a rock. His eyes, too, which look upward, might be mistaken for barnacles attached to the rock. Growing out of the Angler's head are several long, slender, upright stalks. The front stalk ends in a leaf-like structure. It was supposed for many years that the fish waved these stalks to and fro in the water to attract other fish within his reach. Some naturalists now say this is not true, but they do not give us any other good reason why the fish should have such curious members. It was from this supposed use of his "tackle" that the fish got his name of Angler.

He is also called the Fishing-frog, because he can give a little upward spring, like a frog, in order to seize his prey; and as for his other name of "Goose-fish," it is said that he can capture and swallow a wild goose or duck. This does not seem improbable, when we remember that he has a mouth half as wide as he is long, and an appetite to match his capacity.

The Angler spawns in summer, on our eastern Atlantic coast. One fish yields thirty or forty thousand eggs, which float near the surface of the water in a ribbon-like strip, perhaps twelve inches wide and often forty feet long. The eggs adhere to each other in a glutinous mass. The Angler is able to live out of water for some time, and has been known to eat other fishes caught at the same time as himself, after they had been thrown ashore.

## THE TUNNY

ALONG our northeastern coast, the name "Horse Mackerel" is given to a large fish which should properly be called "Tunny." The Tunny is the largest of all the bony fishes, for the sharks are without a bony skeleton and the whales, you must remember, are not fishes, but mammals. So the Tunny stands at the head of the bony fishes in size; and in strength and power, he is worthy of his size.

The Tunnies ordinarily taken are eight or nine feet in length, but sometimes one grows to be twelve or fifteen feet long and weighs a thousand pounds or more. He is black above, silvery on the sides and white underneath.

The Tunny feeds on all fish smaller than himself and is particularly fond of mackerel. He is usually seen in the neighborhood of a school of mackerel, and sometimes plunges through the fishermen's net, in his effort to reach one of them. He swims very fast and few fish can get away from him. But he runs away himself when he sees a whale approaching, for a Tunny makes just a meal for the whale, and has the good sense to swim away when he appears.

You can see that it would not be easy to catch a fish as large and strong as the Tunny with a hook and line, or in a net. As he swims at the surface of the water, he is usually taken by harpooning, in the same way that the swordfish is captured. In New England waters, he is captured in traps, and in the Mediterranean Sea, where Tunny-fishing is an industry of great importance, he is taken in a very strongly-made, funnel-shaped net, as much as a quarter of a mile in length.

Very little is known about the spawning habits of this great fish. In this country his flesh is seldom used at table, although it is sometimes fed to fowls. But from some parts of the fish an excellent quality of oil is obtained. Sometimes one fish yields as much as twenty gallons of oil. In Europe, the flesh of the Tunny is greatly liked, as we may judge from the number of people engaged in the Tunny fisheries of the Mediterranean; but it is not sold to be eaten in a fresh state, but salted or preserved in oil for future use. The Tunny is a warm-water fish, and appears on our northern coast only from June to October.

The Bonito, a fish which belongs to the same family as the Tunny, is much smaller. He weighs from six to ten pounds and is often sold as "Spanish Mackerel." He is a very active fish and a swift swimmer—one of the swiftest of which we know.

## THE MULLET

THE Mullet is one of the most common fishes of the South Atlantic and Gulf waters, and, in the states washed by those waters, is an important food fish.

The Mullet is a bottom-feeder, and takes a bite of mud with as much apparent relish as if it were meat. What he really does, however, is to filter out the earth and retain the animal life which exists



in the mud. He has feeble teeth, or none at all, but his filtering apparatus is excellent. He does not prey on other fish, but, unfortunately for him, nearly all the other fishes, larger than himself, find him excellent for food. So between his enemies in the sea and the men with nets, the Mullet finds it hard to escape serving as a meal for somebody.

The Mullet spends most of his time in still, shallow water, over a grassy or sandy bottom. He travels with his companion in schools, and when he finds a mouthful of satisfactory food, the other Mullet swim up in great haste and flock about him, as hens flock about one of their number that has just pulled out of the ground an especially attractive worm.

The spawning grounds of the Mullet are in brackish or fresh waters, at the heads of bays or in bayous. They begin to assemble in schools, in summer, and at this season they often swim at the surface, and sometimes leap entirely out of water. They swim against the wind and the tide. In the fall they run in such vast schools that the noise they make by splashing in the water can be heard at a distance of a mile or more.

The Mullet usually weighs from five to seven pounds. The flesh is eaten fresh or salted, and the roe is also eaten either fresh or dried in the sun and salted. The Mullet is not so important a fish in the states north of Florida, where other fishes are more popular. In Europe the Gray Mullet is a well-known fish. He is similar to the American Mullet in his habits.

The Mullet of ancient times was the fish we call the Red Mullet or Sun-mullet. The Romans were very fond of the flesh of this fish, and one of their customs was to introduce the living fish at a feast, in order that the guest might watch his display of changing colors, as he slowly died. The fish was then cooked and eaten, as a part of the feast, and the liver, minced in wine, was used as a sauce for the flesh. The fish has a pink color, with yellow stripes on the side, but as he dies, he shows shades of purple and red.

## THE TARPON

WHEN you hear the word "Tarpon," you think at once of Florida, for Tarpon-fishing has become one of the popular sports of the winter resorts along the Florida coast.

The Tarpon is a member of the Herring family, but is much larger than the ordinary herring or the shad, for he grows to be six feet long and often weighs one hundred and sixty pounds. He is sometimes

called Tarpum, Silver King, or Grande Écaille, which means **Great Scale**. Nobody seems to be able to tell us just how the name "Tarpon" originated, but the last two names are surely appropriate. This fish has scales which measure from one to three inches in diameter and fully three-fourths of each scale is exposed. "Silver King" is equally as good a name as "Great Scale Fish," for the scales look as if they had been silver-plated. You can image what a beautiful fish the Tarpon is. On his back, as with other Herring-fish, his scales grow dusky, but his silver mail flashes and sparkles from his sides with wonderful brilliancy.

The Tarpon may be taken with a rod and line, and when he is angled for in this way, Tarpon-fishing is exciting sport. If you have never fished for anything larger than bass or pickerel, fancy your sensations if you should find at the end of your line a Tarpon six feet long and weighing more than you do, yourself!

The Tarpon makes a game fight for freedom, and in his struggles sometimes leaps over the boat in which the fisherman sits or stands. Fishermen have been seriously hurt by Tarpon which leaped from the water and struck them,—unintentionally, of course,—while they were sitting in a boat.

The Tarpon is found only in the warm waters which wash the shores of the southern states and the West Indies. His principal food is other fish, like the mullet, of which he is very fond. Perhaps he learned to jump so high and so far out of water by trying to catch mullet, which have the same habit. His mouth opens on the top of his snout and not at the end, as with other fish, and fishermen say they have seen him apparently standing on his head in the mud, trying to reach little sea animals, which he could not get in the ordinary way because they were beneath instead of above him. But he is able to eat crabs,—hard-shell crabs,—which he crushes in his strong jaws without difficulty.

During the winter and early spring, the Tarpon is in his best condition to serve as food. In the middle of the summer he becomes lean, and, at the same time, loses his fighting spirit.

The scales of the Tarpon are used in making fancy-work and souvenirs, which are sold to tourists who visit Florida in the winter. No tourist can be said to have "done" Florida, nowadays, unless he has caught at least one Tarpon, and, as the fish are plentiful, he may catch as many as he likes.



## THE HERRING

THE Herring-fishery is one of the most important of the world, and, in times past, was even more important than it is now.

To the people of Scotland, Norway, Denmark and other countries on the German Ocean, it is still of great moment, and, on the New England and Canadian coasts, rivals the cod and mackerel fisheries.

There are a hundred and thirty different species of fish, which are classed as members of the Herring family, including Alewives, Shad, Sardines and other well-known fish.

The common Herring is found in the northern temperate waters only. It appears in the shallower waters of the coasts which it frequents at the spawning season, and for the rest of the year disappears in deep waters. A single fish deposits in the sand about seventy thousand eggs. As Herring live in immense schools, it is easy to see why they continue to thrive and increase from year to year, notwithstanding the fact that millions are caught annually.

The Herring grows to be from twelve to eighteen inches long. He has a weak organization and is preyed upon by many other fish, like the dogfish, etc., which follow the great schools of Herring and feed upon them ravenously. The Herring eats small sea animals, like shrimps and crabs, and fishes smaller than himself.

Herring are usually taken with nets; and when they are "running" well, the number caught is enormous. A small proportion of the catch finds its way to market as fresh fish, but the greater part goes to the curer, who either smokes the fish or salts them in brine.

The Menhaden is a fish of the Herring family, and the catching of this fish along the coast of New England is an important industry. Menhaden appear on the Atlantic coast in spring, along with the shad and bluefish; and in winter go to the warmer waters of the tropics or swim far out to sea. They swim in great schools, near the surface of the water, and men, birds and other fishes thus find them an easily-caught prey. Their coats glitter with the silver-like luster that is conspicuous in all members of the Herring family, and at night they are phosphorescent.

The Menhaden has no teeth, but, instead, several hundred fine bristles which serve as a strainer. Its food is largely composed of minute forms of sea life found in mud, and hence the necessity of a strainer in the fish's mouth.

Menhaden are used as bait in fishing for cod and mackerel, and large quantities are sold for this purpose. They are also "rendered"

to yield large quantities of oil, and the refuse of the oil factories is made into fertilizer. Young Menhaden are canned in olive oil and sold as "American Sardines," and any one who does not think them a very rank and shameless imitation of the delicious, sweet, real sardine or pilchard, also a member of the Herring family, which comes from the Mediterranean, must have a remarkable taste in the matter of fish.

Some of the voracious fishes, like the cod, bluefish, and hake, depend largely on Menhaden for food, and so important is this fish, not only as a catch, but as food for other fishes, that if it should disappear from our waters, some of our best food-fishes might become extinct.

## THE SALMON

THE fishes that belong to the Salmon family include not only the true Salmon, but also the Trout, the Grayling, the Smelt and several other species. The true Salmon is one of the most important food-fishes we have, and the canning of Salmon is a great industry, in which thousands of men are employed. Most of you know the Salmon only from the canned red meat, which is so delicious a food, and which is so cheap that the poorest family may enjoy it.

The Salmon is equally at home in fresh and in salt water. The female spawns, or lays eggs, in fresh water, but at least half the Salmon's life is spent in the ocean. In Europe but one variety of Salmon is known; in this country we have several varieties. The Salmon frequents the waters of the Atlantic and Pacific coast, from the latitude of forty degrees northward. Only cold water pleases the Salmon; he is not found in warm climates.

The Salmon is a beautifully formed fish. His general color is dark blue above, silvery gray on the sides, and white underneath. During the spawning season, some species of Salmon show a beautiful orange color beneath. The full-grown Salmon sometimes attains a length of four feet.

In the spring and summer the Salmon leave the open ocean and enter the bays, where they feed on small fish, crabs and shrimps. They then make their way to the mouths of the rivers, where they remain for a time before they ascend the stream, in order to spawn. After changing from salt to fresh water, they feed on insects, worms and fish fry. When the time for ascending the rivers comes, they feed but little and travel up stream as fast as they can. So swiftly do they swim, that it is said a Salmon can travel twenty-five miles in an hour. These fish travel great distances to reach their spawning-beds. They go up the Yukon River, in Alaska, a thousand miles or



more. **They** travel in great numbers, and when they reach the narrower parts of the stream, are packed so closely together that the river seems to be a moving mass of fish. Bears wade into the stream and throw the Salmon out with their paws; the Indians catch them with their hands.

One of the remarkable things about the Salmon is his ability to pass the waterfalls in the streams he ascends. When he comes to a waterfall, he sinks as deep as he can in the water at the foot of the hill and then darts upward with great force. He is able to spring from six to ten feet above the surface of the stream, and if he does not get above the fall at the first leap, he makes a second spring from the rocks where he has fallen. Of course this is hard work, and after he gets above the fall, he rests in still water for a time, before going farther up stream.

When they have arrived at their spawning-place, the male and female fish unite in digging trenches in a sandy or gravelly place on the bed of the stream. They plow up the sand with their noses, and deposit the eggs in the trench so formed. The eggs are then covered with sand, so that other fish may not find and eat them, and the parent Salmon are ready to return to the ocean. They give the spawn no further attention, and it takes from five to seven months for the eggs to mature. The fry when born must care for themselves. Thousands of them are swallowed by larger fishes as soon as they leave the egg. But as a large Salmon deposits from fifteen to twenty thousand eggs at one time, the fry are so numerous that many escape their enemies. Salmon eggs are of a yellow or reddish color and measure about a quarter of an inch in diameter.

The fry when hatched are about three-quarters of an inch long. When the little fish has grown to be seven or eight inches long, he is marked with red spots and bars, and is now called a Parr. When he is two or three years old, he leaves the fresh water, in the spring, and descends to the sea. At this time his color changes to bright silver and he is called a "Smelt." The Smelt remains in salt water for several months and then returns to the river where he was born. He is now known as a Grilse, and is very graceful, active and strong. Sometimes he leaps higher than a full-grown Salmon. After remaining in the upper water of the stream until spring, he returns to the sea and is now called a Salmon. He eats a great deal, grows fat, and when spring comes again returns to the river to spawn for the first time. One of the notable traits of the Salmon is that he always returns to the river where he was born, to breed, and this habit has made it possible to stock rivers with Salmon, placing the spawn in the beds of streams where Salmon have not previously been found.

Salmon grow from tiny fry, three-quarters of an inch long, to a length of four feet, and weigh thirty, forty or even sixty pounds. They are "gamy" fish, and the angler must have no little skill in order to catch them with hook and line. The great canning factories employ men to catch them in nets or traps, and thousands of fish are thus caught in a short time.

The Land-locked Salmon is found in lakes and rivers from which he cannot go to the sea, by reason of high dams or other obstructions. He spends his life in fresh water, but otherwise has the characteristics of the Salmon of the ocean.

## THE TROUT

THE Trout are members of the Salmon family. One large species is called the Salmon Trout, because he is so much like the salmon. This fish lives chiefly in the mouths of rivers and is a greedy feeder. He migrates singly instead of in a school, like the salmon, and spawns in the fall or winter. He sometimes reaches a length of three feet, and weighs as much as thirty pounds.

The Lake Trout vary in size, shape and color, according to the waters in which they live. In the Great Lakes, they are usually brown or gray, mottled with lighter shades. They seem to be always hungry and sometimes swallow fishes nearly as large as themselves. They are often as large as Salmon Trout. The number of eggs they lay varies according to the size of the fish and, in large fishes, the eggs may number as many as two thousand.

The Speckled Trout, or Brook Trout, is one of the most sought fishes of the eastern states. He is found in the lakes and streams east of the Alleghany Mountains and in the waters which flow into the Great Lakes.

Fish that live in still waters are stouter and larger than those that make their homes in swiftly-running water. Their colors, too, vary according to the waters they inhabit. In lakes where the waters are deep and dark, Trout become almost black; but our Brook Trout have beautiful coats, dusky above and yellowish underneath, with little round spots of orange and crimson. They are beautiful fish. Their scales are so small and fine, that the skin feels smooth instead of very rough, as in the case of some fishes.

Trout seek cool, clear water. A swiftly-running stream, with a gravelly bed, is their favorite resort. They do not like muddy bottoms. During the summer, they lie at the bottom of lakes, where cool springs send up cold, fresh water, or in the running water of streams,



or in deep pools, where they lie for hours in the shade of a rock. When autumn comes, they go as far up stream as they can and lay their eggs in little nests, which the female makes in the gravel. She brushes away the sand with her tail and removes pebbles with her mouth. Trout choose mates, as birds do, and the male trout swims back and forth before the female, displaying his fine colors and coaxing her to join him in spawning. The spawning season lasts from three to six months and during this period Trout are protected by law from the fisherman, in many states. A Trout's egg is about an eighth of an inch in diameter, and is yellow or, sometimes, colorless. The development of the egg varies according to the temperature of the water. In water at about 50° they hatch in fifty days.

Brook Trout sometimes weigh as much as four pounds, but the angler usually finds that his catch weighs from eight ounces to two pounds. They do not feed on almost anything that is eatable, like the greater Lake and Salmon Trout, but choose their food daintily, although they are large eaters. Small fishes form a part of their food, and they also eat grasshoppers, flies and other insects which alight on the water. When a Trout sees a fly on the surface, he darts straight upward and seizes it as he rises. In this he differs from the salmon, which leaps from the water and seizes his prey as he turns downward.

The Trout is one of the gamiest of fresh-water fishes. He pulls and tugs at the angler's line until the fisherman, if he is new at Trout fishing, thinks he must have hooked a monster. But the Trout is not easily caught, for he is as sly and cunning as he is strong and active, and if a shadow darkens the water, he darts quickly behind a rock or under the edge of the bank and remains quiet until he is satisfied that the danger is past.

Brook Trout cooked when freshly caught are delicious eating. They have a flavor all their own, which is unsurpassed by that of any other fish.

## THE BASS

**B**ASS-FISHING is considered by some even better sport than casting for trout or salmon, for the Bass is a gamy fish and gives his captor a lively tussle before he consents to be drawn ashore.

The Striped Bass, or Rock Fish, as he is called in the South, has a brown back and on his sides a suit of silvery-gray scales, with five dark stripes marking his body lengthwise. He is a common fish in the waters of the Atlantic coast, as far south as Florida. His favorite haunts are in open reaches of large rivers. He ascends the Potomac River to Great Falls, twelve miles above Washington, and goes up the

Hudson River as far as Albany. He descends to the sea, but does not usually go far from shore. At high tide, he may be seen in the surf, along the beach, looking for crabs and shrimps, on which he is a voracious feeder. In river waters, he depends upon minnows for food.

The flesh of the Striped Bass is excellent food, and many thousands of these fish find their way to the table annually. Those which weigh less than a pound are usually fried as "pan-fish"; those that weigh seven or eight pounds are boiled. Striped Bass have been caught which weighed a hundred pounds, but the largest ordinarily seen do not weigh over fifty pounds.

The Striped Bass spawns in May or June, and lays from five hundred thousand to a million tiny eggs, which are smaller than the eggs of the shad.

The White Bass, or Striped Lake Bass, is found in lakes and ponds, and the deeper parts of rivers, in the region of the Great Lakes and the upper waters of the Ohio and Mississippi rivers. He is usually from one to three pounds in weight. The Yellow Bass, another species, is found in the lower waters of the Mississippi.

The White Perch belongs to the Bass family, but his coat is nearly all light colored and he has no dark stripes on his sides. He dwells in fresh tidal rivers, and spends the winter in the deeper waters of bays. His favorite food is the spawn of other fish, especially that of the shad, together with crabs, minnows and insects. His weight seldom exceeds one or two pounds. The White Perch is a follower and a companion of the Striped Bass, in whose society he is often found.

At least twenty varieties of Sea Bass are found on the Atlantic coast, and a lesser number in the waters of California. The Striped Bass, like the Perch, has two distinct back fins, but in the Sea Bass these two fins are joined so as to form one long fin. Only the front half, however, is armed with the sharp spines that make Perch and Striped Bass "prickly" to handle.

The Sea Bass likes deep waters and seldom rises to the surface. He feeds at the bottom, and his favorite place to seek food is among rocky ledges, where he finds many small sea creatures.

To fish for the Sea Bass in northern waters, you must sink your line from twenty to fifty feet; in the South, where the water near the surface is warmer, and the Bass seeks a cooler retreat, he is to be found only at a depth of from seventy to a hundred feet. His favorite time to feed is when the sea is quietest, at the turn of the tide. He lies chiefly under the stones and in cracks in the rocks, and is slow and heavy in his movements. Sea Bass live in great schools, and are netted by thousands, for they are excellent food and are always in demand in market. In weight, the Bass of northern



waters average about a pound and a half, although Sea Bass weighing three pounds are often taken. In the South they are smaller. Among most varieties of fish, it is not easy to tell the male from the female, but the male Sea Bass has a distinguishing mark in a hump on the top of his head. This is larger during the breeding season, in July and August, than at other times; and during that season, also, the fish has brighter colors. At other times his coat is more or less dusky or gray, and is sometimes so dark that in the South the Sea Bass is called "Blackfish." We should remember, however, that the real Blackfish is the Tautog.

The Black Bass is found in lakes and rivers and has many names, according to the part of the country in which he is found. Rock Bass, Spotted Bass, Green Bass and Black Perch are some of them. The weight of the fully grown Black Bass is from two to three pounds.

Black Bass multiply very fast and as they are sharp fighters, they soon drive from the water in which they live, pickerel, trout, perch, sunfish and other fish which are unable to do battle with them. They eat fish, including their own young, and rise to the surface for moths and flies. A Black Bass will even jump from the water and drag a frog off the lily-pad on which he sits.

Black Bass spawn in gravel beds. The eggs are smaller than those of the trout, and one fish deposits as many as fifteen thousand eggs. They are placed in a hollow scooped in the sand, and until they hatch, a week or ten days later, the parent Bass remains near and drives away other fish which come to prey on the spawn.

The Bass is a very vigorous fish and has been known to live out of water for eight or ten hours.

## THE PIKE

THE Pike is found not only in America, but also in Europe, where he has been known from the earliest times. He has been made the subject of many stories which refer to his cunning and the great age he is supposed to have attained.

To the same family as the Pike belong the Maskalonge and the Pickerel. All are fresh-water fish. These fish have long, slender bodies, with broad, flat, powerful jaws and sharp teeth. They can dart through the water at great speed. They have wolfish appetites and prey upon all other fish within their range. They have but one dorsal or back fin, and that is placed far back on the body, near the tail, which heightens their appearance of slenderness.

The true Pike is found in the lakes and rivers of northern Europe, and in America from Ohio to Alaska. His coat is greenish or brown, marked irregularly with white or yellow. In this country, Pike are rarely seen of a length greater than four feet, and at that size they weigh about thirty-five pounds.

The Maskalonge, whose name is spelled in several different ways, is as large as the Pike, but is not so widely distributed. The Great Lakes and St. Lawrence River regions furnish most of the Maskalonge. This fish has a larger head than the Pike. His dark gray sides are spotted with round marks of black and brown. Maskalonge weighing as much as seventy pounds, are sometimes caught in the Great Lakes.

The Chain Pickerel is found in all the states of the Atlantic coast, where there are ponds or creeks of clear water with grassy bottoms. He is more slender and graceful than the Pike. A large specimen measures three or four feet in length and weighs seven or eight pounds. His name comes from the fact that a network of brown lines covers his yellowish-green or brown body.

The Brook or Pond Pickerel is the smallest of the family. He grows to be from twelve to fifteen inches in length and weighs four or five pounds. His color is dark green, banded with black, and his fins are bright red.

The fish of the Pike family spawn in shallow water, and a single fish deposits from one hundred thousand to three hundred thousand eggs. The fry are hatched in about two weeks.

The Pike eats all kinds of fishes, including those of his own kind, and preys upon frogs, mice and birds which venture upon the water. From his hiding-place among the weeds, he watches a duck settle upon the water. He judges the distance to a nicety, darts upward like an arrow and seizes the bird in his strong jaws. Struggle and flutter as it may, the duck is quickly drawn beneath the water and drowned, and then the Pike greedily devours his prey. The Brook Pickerel seizes a frog in the same way.

In waters where Pike, Maskalonge, or Pickerel dwell, other fish soon disappear. Even the spiny-backed perch is swallowed by the savage Pike, which soon makes himself sole master of the lake. His great speed and biting power overcome the swiftest flight or bravest resistance of other fishes.

Pickerel like clear, slow-moving waters, where there is an abundant growth of grass and weeds. They are more active by night than by day. During the day, they lie quietly among the weeds, and a skillful Pickerel fisherman often hooks a gamy fish by poling his boat noiselessly through the shallow water while he holds a trolling



line, the hook of which is baited with a young frog. Once hooked, the Pickerel makes a determined fight. He is a "game" fish, like his larger relatives, the Pike and Maskalonge. The flesh of these fish is palatable, but greatly inferior to that of other fish which may be caught in the same waters.

## EELS

**Y**ou have seen people who decline to eat Eel, because that fish "looks so much like a snake!" As a matter of fact, the Eel bears no resemblance to the snake, except that he is long and slender, for he is a true fish; and moreover, his flesh is excellent eating.

The common Eel is found in lakes, ponds, rivers and near the shore, in the sea. Many fishes, like the salmon and shad, leave the salt water and go to fresh water to spawn. Eels do the very opposite. In the fall, Eels go down stream to the brackish or salt water and there deposit their spawn. It is said that, after doing this, they never return to the fresh water, but remain in the sea to die. In the spring, the young Eels go up the stream and travel as far as they can. At night they sometimes leave the water and crawl along the grass in order to get above an obstruction in the stream or to reach a pond.

The Eel has a round body, flattened at the tail, and a pointed snout, with eyes very near the end. The skin seems smooth to the touch, but most kinds have scales, like other fish, which are deeply set in the thick skin. "As slippery as an Eel" is a very forcible expression, however, for when you try to hold one of these wriggling fish, you need sand on your hands, and if you happen to catch him on a hook, as you may, the chances are that he will tie many hard knots in your line before you can conquer him.

The Eel is a bold and greedy fish. He eats almost all kinds of fish, except the savage gar-pike, and is fond of shrimps and crawfish. He moves about in all sorts of holes, and turns over stones to look for these tidbits.

An Eel often drives straight into the mud or sand, and wriggles his way through, so as to come up at a place several feet distant. And, indeed, this fish buries himself in the mud and remains there during the winter, for he does not like the cold.

The common Eel is usually about two feet in length, but occasionally a big fellow is captured that measures four or five feet.

The Muræna is an Eel found in tropical waters. He has a brown coat, handsomely marked with yellow. His teeth are strong and sharp and the fisherman has no desire to come within reach of him. The

Romans were very fond of the flesh of the *Muræna*, which they served at their feasts. Wealthy Romans maintained private Eel ponds, where the fish were fattened for the table; and the story is told of a master who ordered a slave, that had committed some fault, to be thrown to the *Murænas*. So voracious were the fish, that the man's body was entirely consumed in a short time.

In tropical waters are found Electric Eels, which have the power of giving other animals a shock, just as the torpedo-skate has. They have been known in this way to kill horses and mules, which were crossing a stream.

Eels can live longer out of water than other fish, and are often carried to a considerable distance, packed in wet grass, without causing them much discomfort.

In Europe great numbers of Eels are eaten, and in this country, also, they are used as food, to some extent. They are usually caught in "Eel-pots," or basket-like traps, but are often taken by spearing, especially in winter, when they are speared through holes in the ice. As they are especially active at night, they are often caught with "night lines," which are long lines weighted at the end and having many hooks baited with fish and meat, and stretched across the stream. In the morning, the fisherman finds at least two or three Eels caught on his "night lines."

## THE CARP FAMILY

THE family to which the Carp belongs is the largest among the fishes and includes more than two thousand species, which are found all over the world, except in the polar regions, South America and Australia.

The Carp is a native of the rivers of China, but for several centuries has been a domestic fish in Europe and is now placed in stock ponds in this country. Opinions differ very much as to the food value of Carp, Dace, Suckers and other fish of the family to which they all belong, but in Europe, Carp has long been considered an excellent food-fish. The Carp feeds on worms, mollusks, water plants and other soft food, and will fatten on vegetables. He often lives to a great age, sometimes two hundred years.

The Goldfish is a Carp, and in his natural state his color is greenish brown. The young Goldfish are always dark in color and grow red as they grow older, but this is the case only when they are kept in captivity. If Goldfish escape from fountains or park ponds into rivers or large waters, they soon regain their greenish-brown coat. Goldfish are very hardy, and for that reason are among the best fish



to keep in the aquarium. The Japanese Goldfish, which have three tails, thin and "wavy," are very pretty. There is another kind of Goldfish that has a coat, part silver and part gold.

The little Minnows, with which every boy is familiar and which are everywhere used as bait, in angling for larger fishes, are relatives of the Carp. Shiners, Chub, Dace and Suckers go in the same list.

There are about sixty species of Suckers, found in various parts of the world. They vary in length from six inches to three feet. The Suckers that most of us are familiar with in our brooks and rivers are rarely more than twelve to eighteen inches long. They are slow-moving fishes, and lie for hours at the bottom of a stream. They feed on insects, small water creatures and mud. They do not seize their prey with their jaws, but suck it into their mouths. Suckers are usually caught by snaring them with a loop of fine wire, or by spear-  
ing. When taken from clear water, the Sucker may be cooked for eating and is not unpalatable; but he seems to have as many fine bones as the shad, and when he comes from muddy, uninviting waters, his flesh is not usually so tempting as to be in great demand.

## THE STICKLEBACK

THE Stickleback is an interesting little fish that builds a genuine nest, much like the nest of a bird, only not so large. We call him Stickleback, because on his back grow sharp spines, sometimes two or three, and, in some species, many more. He is a small, slender fish, only two or three inches long. He has the power of changing color to suit his surroundings, so that he may be green at one time and brown at another.

The Stickleback is a lively little fish, and if you wish to see how pugnacious he is, you can get some Sticklebacks for your aquarium, and watch them there, for they live very well in captivity.

The nest-building habits of this fish are very interesting. When the breeding season arrives, the Stickleback selects for his nest a place among the water plants, where the water flows, not too swiftly, but with current enough to keep it clear. He nips off stems and bits of plant stuff, which he fastens together by means of a glue-like substance prepared within his own body. With these he forms a sort of platform, which is secured to plants growing in the water. He weights the platform with sand, rubs against it, and slaps it with his tail, to make sure it is firm, and then builds up the sides of the nest. He glues or plasters it all together, and makes two entrances. The male fish always does this work by himself, before he selects a

mate, and when he has found one he has a house all ready for her at the start. Now, an oriole would select his mate first and then let her build the nest.

The female Stickleback enters the nest and deposits her eggs. It takes her about six minutes to do this, and, in the meantime, Mr. Stickleback swims around outside, very much excited, and ready to fight any fish that may come along with a disposition to interrupt. When Mrs. Stickleback has laid her eggs, she goes out of the nest by the second door, and Mr. Stickleback enters and deposits the milt on the eggs. The milt is what makes the spawn productive. But this is not the end. Mr. Stickleback goes off in search of other helpers and brings back one after another to the nest to lay eggs, until the nest is filled with spawn.

The two holes in the nest make it easier for the fish to go in and out, but there is another excellent reason for having them. To make the spawn fertile, it is necessary that it should lie in running water, and the two holes are so placed that the current runs directly through the nest, which shows that Mr. Stickleback knows a great deal about nest-building.

Now, how large is this nest? About the size of a hazelnut! And the eggs are about the size of poppy seeds—you know how tiny those are. Such, at least, is the case with the fresh-water Stickleback, and the larger Sticklebacks, which live in the sea, have similar habits.

## THE STURGEON

THE Sturgeon is a fish of which we often read in fable and history, for he has been well known for hundreds of years. In ancient Rome, the flesh of the Sturgeon was so esteemed that no feast could be complete without it, and fabulous prices were paid for it. In Europe, the Sturgeon is still eaten, but in this country, the flesh is not in great demand. The roe of the Sturgeon, however, is considered a great delicacy. It is washed with vinegar, salted, and dried, and is then called caviar. This commands a high price. You can buy it at the grocer's in the little cans in which it is put up, for it is shipped all over the world. Some caviar is made in this country, but the finest comes from Russia, where the Sturgeon is a common fish and grows to great size. The swimming-bladder of the Sturgeon is dried into isinglass, which is used in making various jellies for the table.

But what is the Sturgeon like? His chief characteristic is his armor, which consists of bony plates set in his skin. His snout is flat



and extends beyond his mouth; but when the Sturgeon wishes to feed he can throw his mouth forward. He is without teeth, but his jaws are hard and he can readily seize and swallow the fishes, worms, and water-insects, upon which he lives.

The common Sturgeon, found in the waters of the United States and of Europe, varies from five to eighteen feet in length. One of the great Sturgeon of Russia reaches a length of twenty-five feet and a weight of a ton and a half. There are smaller species found in the lakes, and called Lake Sturgeon.

The Sturgeon goes up the river to spawn, like the salmon, although he does not go so far from the sea. The roe of the fish is very large and sometimes weighs one-third as much as the fish itself.

Another fish that has his body covered with hard, bony scales is the Gar-pike, sometimes called the Bill-fish. This fish is found in the lakes and rivers of the United States and of Central America. He is about five feet long, with a slender body and a long snout or bill, armed with teeth. The Gar-pike frightens away fishes, so that he is heartily disliked by fishermen. The Gar-pike spawns in May or June, and the eggs are covered with a sticky wrapper which adheres to the first thing it touches. When the young fish comes from the egg, he has a large mouth, on which is a row of suckers. With these he holds fast to a rock for two or three weeks until his fins have grown, when the suckers disappear, and he is able to swim about and find food.

## THE PERCH

THE Yellow Perch is one of the familiar fresh-water fishes of the northern part of the United States. He is found on the Atlantic slope of the Alleghany Mountains, in the region of the Great Lakes, and in the upper Mississippi Valley; but neither on the Pacific coast nor on the western slope of the Alleghanies.

The Perch is not a migratory fish, like the trout, but spawns in the waters where he lives the year around. He prefers quiet waters and would rather live over a pebbly bottom than over mud. In small ponds he does not grow to be very large, but when he descends the stream to the brackish water near the tidal region, he becomes larger. The Perch we ordinarily catch in the pond weighs from four ounces to a pound and a half.

His color is a brassy yellow on the sides, with black running along his back, and bars of black across his yellow sides. His body is white underneath and his lower fins are shaded with red. His front dorsal fin, which is the fin on the back nearest the head, is ribbed with

spines which have sharp points. A scratch from one of these spines makes a painful wound, and the young fisherman may have a sore hand if he does not remember to press the fin down on the fish's back when he takes his Perch off the hook.

Perch are not solitary fish, as trout are, but live and travel in schools. Where you find one, you find many. One curious fact about these fish is, that the larger and smaller ones travel in separate schools.

In the winter, Perch seek deep water, over a bottom of fine grass; and if the water becomes very cold, they remain torpid, without eating, for a considerable time. In spring and summer, however, they are very lively and voracious. They prey upon other fish, which they follow and attack boldly; they soon drive the trout from the waters they inhabit. The Yellow Perch eats his own kind, as well as fish of other families, and grubs, worms, and insects also furnish him with food. Sometimes he rises to the surface to seize a fly or a grasshopper, but as a rule he remains in deep water.

The spawning season of the Yellow Perch is from March to May. The eggs are no larger than poppy seeds. They adhere to each other in a mass, which forms a strip an inch or two in width and several feet long. The Perch does not bury its eggs in the gravel, as the trout does, but fastens one end of this long strip to a stone or a weed, in shoal water. Other fish eat these eggs, and so do birds, which plunge beneath the water to get them. If it took any great length of time for the eggs to hatch, all of them would be eaten long before any Perch fry appeared, so nature has made the time of hatching short. In a week or ten days after the eggs are laid, the fry appear.

The Pike Perch belong to the same family as the Yellow Perch. They are larger than the latter, more slender in form, like the true Pike, and their back fins are spotted with black. In their habits they resemble the Yellow Perch. "Sand Pike," "Wall-eyed Pike," "Grass Pike" and "White Salmon" are names applied to the Pike Perches, in different parts of the country.

The "White Perch" is not really a Perch, but is a member of the Bass family.

Perch are found in Europe, as well as in this country, and are highly regarded as a food-fish. Our Yellow Perch is excellent eating during the spawning season, when the fish is fat and sweet; at other seasons it is softer and has a less pleasing flavor.



## THE SUNFISH

THE Sunfish has many local names, in different parts of the country. "Pumpkin Seed," "Flat," "Brim," "Red-breast," "Rock Bass," "Strawberry Bass," "Calico Bass," "Blue Gill," and many other titles are given to him.

The Sunfish has a disk-shaped body, thin and flat, and is appropriately called "Sunfish," because he is so nearly round and has bright colors. He is spotted and dappled with black, brown, green, yellow, and red, and the name "Calico Bass," applied to some species of this family, is apt and suggestive.

This fish is usually found in still, clear waters. Where there are yellow perch, you find the Sunfish, also, as a rule. He thrives in streams and ponds too small for bass and too warm for trout.

In the spring, the female Sunfish selects a spawning-place, near the shore of the pond or brook, in shallow water. She removes the weeds from the bottom, until she has cleared a space about a foot in diameter. Here she digs to a depth of three or four inches and in the nest thus made she deposits her spawn. While the eggs are maturing, she remains near the nest and drives away other fishes which come near.

The Sunfish feeds on small fishes and worms. Large specimens sometimes weigh as much as two pounds, but the "Pumpkin Seed" with which the boy fisherman makes acquaintance is usually about two or three ounces in weight. Sunfish bite greedily at a baited hook, and the disgusted fisherman often draws up little fellows not larger than a silver dollar. In many parts of the country the Sunfish is eaten, but the flesh is not so toothsome as that of bass or perch.

## THE CATFISH

THE Catfish family is represented in all the fresh waters of the United States east of the Rocky Mountains. They like best still ponds, or sluggish streams which have muddy bottoms. They live and feed near the bottom and in the darkest and most impure waters. They are often found, however, in clear lakes and rivers, where they seek out still pools with muddy bottoms in which to live.

The most familiar member of the Catfish family is the Horned-pout, also called Bull-pout, Bull-head, and "Preacher." The latter name is given to him because of the peculiar noise he makes with his mouth, when he is taken from the water. The boys call it "preaching." Most fishes do not utter sounds. The name "Horned-pout" is a good

one, for the word "horned" refers to the sharp spines which grow in front of the first back fin and the side fin. When the fish is taken from the water, he erects these spines, which are as stiff and sharp and poisonous as thorns. Unless you know just how to grasp the fish, you may get a severe prick when you try to take him from the hook. The name "Pout" refers to the wide, pouting lips of the Catfish. From the front part of his snout grow soft, pliable barbels or "feelers," which project above, below, and at the sides, of the head. The Catfish lives in dark, muddy waters and these feelers tell him when he is near any object, just as a cat's feelers assist her in the dark. The skin of the Catfish is smooth, and often slimy, from the ooze in which he has been prowling. His general color is black or dark brown above, and white underneath. This fish is not at all dainty as to his food. He eats "anything and everything." He likes worms, which are the small boy's favorite bait for Catfish, but he eats any other animal substance, whether he finds it living or dead. He finds many tidbits among the refuse from drain and sewer pipes that empty into a river. In size this fish varies from seven or eight inches to a foot or more in length, and weighs from six ounces to two pounds. Where Horned-pouts are caught from clear waters, as in the streams and mill-ponds of New England, their flesh is excellent. It is pink in color, and when fried in corn meal is delicious to the taste.

In the streams of the West and South, and in the Great Lakes, are species of Catfish much larger than the Horned-pout, which they resemble in structure and habits. "Channel Cats," or "Blue Cats," as they are sometimes called, are found in river channels, and are from five to ten pounds in weight. The Great Mississippi Catfish weighs from one hundred to one hundred and fifty pounds, and the flesh, which is used for food, is cut in steaks, like that of the swordfish.

The Salt-water Catfish is found along the Gulf coast and as far north as Cape Hatteras. He lives along the shore and in the creeks and inlets. Like his fresh-water relative, this fish is greedy and eats any animal substance he finds. Summer is the breeding season, and the spawn of the fish is deposited in a hollow in the sand. One of the parent fish then takes the eggs from the sand and fastens them to his gills. In this position the eggs are carried until the fry are hatched and can take care of themselves. The eggs, which look like clear white grapes, cause the fish's jaws to bulge out, so that his head has a singular appearance.

Catfish are dull biters at a bait, and will nibble at it for some time before they decide to seize it. Then they attempt to swallow bait, hook, and sinker, in one greedy gulp, and it is often necessary to cut the fish open to get the hook free.



## THE SHAD

“**S**HA-A-D! Sha-a-d! Roe Shad!” is one of the street cries heard in some of our cities in the spring. It means that the Shad have “come up the river” to spawn, and that the fishermen have netted them by thousands. The Shad is a larger species of the Herring family, bluish on the back and with silvery sides. In length, he varies from twelve to thirty inches. These fish are found all along the Atlantic coast, and have been introduced by the United States Fish Commission into the Mississippi and Ohio rivers and on the Pacific coast.

The Shad spend most of their time in salt water, but in the spring, as soon as the temperature of the water is satisfactory to them, they run up the rivers, in some cases, for hundreds of miles, until stopped by some obstruction like a waterfall, which they cannot pass, as the Salmon does, by leaping. As soon as the Shad finds a suitable spawning-place (and this is usually a sandy bar in the river), they pair and deposit their spawn in the sand. This is done after sunset and before daylight. The number of eggs in a Shad varies according to the size of the fish, but one fish often yields a hundred thousand eggs. The eggs are about twice as large as the grains of ordinary corn meal. Have you ever eaten Shad roe, properly cooked? If not, then you have yet to taste one of the greatest delicacies that come from the sea. But how strange it seems to think that with every mouthful of Shad roe you eat one or two thousand fishes in embryo.

Shad eat small forms of sea life, and other fishes. They do not often bite at a hook and are usually caught in nets. Not only the roe, but the flesh itself, is delicious, and is much sweeter and finer than that of the herring, or menhaden, whose relative he is. But the Shad is so full of fine, hair-like bones, that it requires some patience to pick out a satisfactory meal without danger of being choked.

A species of Shad called the Hickory Shad is common in the waters of the southern states, and is often sold by street venders in place of the American Shad, but it is a much inferior fish—the flesh is, in fact, almost worthless. If the fish dealer try to sell you a Hickory Shad, you may know it from the true American Shad by the lower jaw, which is much longer and stronger than that of the latter fish. The Hickory Shad often appears in the rivers just before the time of the real Shad, and is sold by unscrupulous dealers to people who are anxious for the season's first taste of Shad, and then who wonder why the fish is, after all, such a disappointment.

## ECHINODERMS

THE Echinoderms include the Star Fishes, Sea-urchins, Sea-cucumbers, and Sea-lilies. They live in the sea and are found along the coasts in every country. Not only do they abound in shallow water, but they live in the depths of the ocean. The name Echinoderms means "having a skin like the Hedgehog," and it is given to them on account of the number of hard spines which project from the inner surface of the body as a protection. The body is flat and round. There are usually five arms which project from this body like the spokes of a wheel. The mouth of the animal is to be found in the center of the under side. The internal organs are protected by a number of plates of matter of the same composition as the shell of the Lobster and of the Oyster. The animal glides over the bottom of the sea and among the rocks by means of projecting snake-like arms. The highest type of this group are the Sea-cucumbers, which take their name from the general resemblance to that form of the vegetable. The Basket Stars have a great number of growths radiating from the center and are so intricately woven that they have the appearance of a small, shell, fancy basket. These animals live upon the decomposing vegetable and animal matter on the bottom of the sea, and act really as scavengers. The Sea-urchins are rounder in form and the marks of the divisions are not so distinct as in the other species. One form of them is quite flat and its outline is comparatively regular, so it takes the name of "Sand-dollar." The mode of locomotion of this group of animals is conducted by what might be called water power. There are a number of pipes and reservoirs throughout the body and when the animal wishes to advance, it first sucks in a quantity of water and then discharges it through the pipes in the leg-like appendages which straighten out under this pressure and the sucker-like extremities of these legs attach themselves to the rocks, and as the animal contracts these, the pull is sufficient to draw the body forward. This principle is continued over and over again and the body advances through considerable distance in a surprisingly short time. The Star-fishes devour a large number of mollusks and barnacles which chance to be in their way. The food is swallowed alive and is killed by the digestive juices which immediately surround it. When a Star-fish wishes to eat an oyster it has the power to expose the entire portion of its stomach so as to completely involve the body of the oyster after the shell has been opened by a strong pull on the part of the Star-fish. The soft portions of the oyster are then absorbed directly into the digestive system



of the Star-fish. The Sea-cucumber lives principally upon the very small forms of animal life which abounds in the sand. To obtain this it swallows large quantities of sand and extracts the food from it by digestion. The Sea-urchin has five teeth in the mouth and lives upon seaweed which these teeth bite off. They increase by means of eggs which are laid in the water and which the parent pays no attention to during their development. The young in the early stages look wholly unlike the parent, but pass through several changes and modifications during their period of growth.

## COLLECTING AND PRESERVING INSECTS

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### COLLECTING APPARATUS

THE absolutely necessary apparatus for general field collecting is a net, a good-sized cyanide bottle, and either a collecting box or a haversack containing pill boxes, envelopes, and alcohol vials. For collecting insects of special groups, the character of these implements varies, and their number may frequently be added to with more or less advantage.

The net varies in accordance with the desires of the collector. The butterfly net, which may be used for collecting all flying insects with delicate wings, such as butterflies, moths, dragon flies, and true flies, may be purchased from supply dealers, or may be made at home by bending a strong piece of iron wire in a circular shape, the ends being abruptly bent down at right angles so as to fit into grooves on either side of the end of a bamboo rod, or walking stick, to which they are permanently bound with copper wire. The net should be pointed and should be made of fine cloth netting, preferably tarlatan, silk gauze, or swiss. The bag should be not less than eighteen inches deep and the ring not less than a foot in diameter. A heavier cloth, such as cheese cloth, should be used for binding the net to the rim. Instead of fastening the iron wire to the rod by means of copper wire, a brass ferrule from a fishing rod may be used, the ring ends being soldered in with melted lead.

For insects which are not so delicate as those just mentioned, and which it is desired to capture, not during flight, but by beating grass, low growing herbage, and even the branches of trees, the frame should be very strong and the net, which may be rounded at the bottom instead of pointed, should be made of some strong, white cloth, like cheese cloth. The net is passed back and forth quickly over low shrubbery and grass, and the contents are examined every few minutes, desirable specimens being transferred to the cyanide bottle.

For the cyanide bottle, or collecting bottle, any wide-mouthed bottle is used. When one is collecting butterflies, a small jar with a ground-glass stopper, the mouth of which is three inches across, is



recommended, but for smaller insects a common quinine bottle or morphine bottle, or even a thick, round-bottomed vial, of the shape of a test tube, but stronger, is convenient. At the bottom of the bottle, or jar, are placed a few lumps of cyanide of potassium, and over these may be laid a little cotton. Some collectors simply place a disk of perforated paper over the cotton; others mix plaster of Paris with water, pour it over the cyanide and allow it to set. The plaster of Paris is sufficiently porous to allow the fumes of the cyanide to fill the bottle, but at the same time keeps the bottle dry. Cyanide of potassium deliquesces rapidly, and unless its surface is covered in this way the moisture will ruin the specimens. It is desirable to put into the bottle a few strips of tissue paper to prevent the specimens from moving about too much, and to absorb the superfluous moisture. Bottles charged with carbonate of ammonia are also used as killing bottles.

The collecting box, or haversack, is conveniently furnished with a shoulder strap, so as to be carried without interfering with the use of the arms. With butterflies and moths, it is well to pin the insects as soon as they are killed, and to pin them to the bottom of a cork-lined box. With other insects, it suffices to place those which are hard-bodied in pill boxes loosely filled with small strips of tissue paper, pinning them after the return from the collecting trip. Soft-bodied insects should be put into vials containing fifty per cent alcohol or ten per cent formalin. Butterflies, instead of being pinned, may be put into small envelopes, their wings having first been folded together over the back, relaxing and spreading them after the return from the trip.

Other apparatus, useful in collecting special kinds of insects, includes the water net, sieve, chisel, and trowel, the collecting forceps, the umbrella, and the collecting shears. The water net may be made of grass cloth, or millinet, with a stout frame and a short handle. When one wishes to scrape up the mud or sand from the bottom of pools, a wire screen net with an especially stout rim of galvanized iron is useful. For minute insects, which live in vegetable mold, moss, or decaying wood, the sieve is very useful. This may be made of wire screen with cloth sides. The chisel is useful in capturing insects which hide under the bark or in the wood of dead or dying trees, and the collecting forceps, which should be small and very pliable, with rounded tips, is useful for picking up small specimens and transferring them into vials and boxes. The umbrella is a very useful apparatus in collecting insects which live upon trees. The collecting umbrella should be lined with white cloth in order that the insects which fall into it may readily be seen, and the handle should be jointed at the middle, so that it may be held with the top reversed and the

lower part of the handle horizontal. Held in this way under a branch, by one hand, the branch may be beaten with a stick held in the other hand. The insects which drop as the result of the jar fall into the umbrella and can readily be captured. Collecting shears are used for the capturing of very delicate insects, such as small moths. The blades are composed of flat net frames, like very minute tennis rackets.

For collecting insects which live upon the bottom of ponds and streams, the common garden rake is useful. With it the debris at the bottom of the water may be drawn ashore and the insects picked out by hand.

#### SOME METHODS USEFUL IN COLLECTING DIFFERENT KINDS OF INSECTS

Many night-flying moths may be captured by "sugaring." A mixture of stale beer and brown sugar, or molasses and water and Jamaica rum, should be prepared in advance and applied with a whitewash brush to the trunks of trees, stumps, fence rails, or other objects in open woods or at the border of a patch of woods. The bait is then visited at night and the insects attracted are captured with ease. Not only are moths attracted in this way, but also beetles and certain other insects. The pulp of over-ripe fruit is also used for this purpose.

The stinging insects, such as bees and wasps, are readily captured, by means of the beating net, from flowering plants. When one is collecting these insects, the net should have an opening in the bottom, which is tied with a piece of string. Driving the insects into the bottom of the net, the collector should grasp the net above them, insert the opening into the mouth of the cyanide bottle and untie the string. This is to avoid the danger of being stung.

Sifting earth and moss is a very successful means of capturing many minute insects, including many rare species, such as blind earth-living beetles, little parasitic hymenoptera and so on. The sea beach, and the beaches of the Great Lakes, are frequently prolific collecting grounds. The trash along the beach, on being pulled over, will be found to harbor many half-drowned insects of different kinds.

#### REARING INSECTS

Even those collectors who are not interested in learning the life histories of insects, consider it desirable to rear their specimens, in order that they may be perfectly fresh and in the best condition for the collection. The caterpillars of butterflies and moths are all easily reared in breeding cages or jars. A simple way is to pot a plant and place it in a box, over which mosquito netting is tied, so that the caterpillar may be watched when feeding upon the leaves. Glass cylinders,



even lamp chimneys, where the insect is small, may be used for this purpose, and the large glass jars known as battery jars are excellent for vivaria. Special cages may be constructed so as to contain earth at the bottom, with wire screen or gauze sides, the food plant being either potted or stuck into a water bottle, the mouth of which is protected with a sponge, so as to keep the caterpillar from crawling into the water.

Where the insect enters the ground to transform to the pupa stage, the earth at the bottom must be kept moist. This is accomplished satisfactorily by having the sides of the bottom perforated and a tin rim placed around to contain water, which thus enters through the perforations from below and does not cake the surface of the earth. The earth used for this purpose should be sterilized by heat and sifted, before use.

For insects feeding upon grasses, a large wooden box should be made, with its bottom perforated. It should be filled with earth, and a net cover, supported on little corner posts, placed over the whole. This kind of box is useful in rearing grasshoppers. Wood-boring insects should be placed in a large bottle, and the wood should be moistened every two or three weeks.

#### PREPARING INSECTS FOR THE CABINET

No pins should be used except those made especially for mounting specimens. The long German pins are the best, and these may be purchased from dealers in entomological supplies. Black pins are better than white pins, since they are less liable to be ruined by verdigris.

In mounting, most insects should have the wings spread. This is the case with all butterflies and moths, with dragon flies, and most other Neuropterous insects, with the larger of the true flies, and with all of the bees, ants, wasps, ichneumon flies, and saw flies. In order to spread these insects, some kind of spreading board is necessary. These are pieces of wood having a groove on the upper surface, which should be deep enough to accommodate the body of the insect and to allow the wings to be brought to the level of the upper surface of the board. There should also be an orifice for the pin, or the groove should be filled with cork which the pin may penetrate. In preparing the board, care should be taken to have the wood on each side of the groove slightly angled outward, so that the insects' wings may be directed upward, at a very slight angle. The insect should first be pinned. With all of those which we have just mentioned, and with which it is necessary to spread the wings, the

pin should be thrust perpendicularly through the thorax, midway between the wings, and it should be inserted to such a depth that only about one-quarter of the length of the pin remains above the back of the insect. After the insect is pinned, it should be placed in the groove of the spreading board, and the wings be set in the proper position with needles or fine pins. They may be held in this position by pinning strips of paper over them, the pins being inserted beyond the wings and not through them.

If the body sags downward, it should be raised to a level position until it dries. The spreading board should be kept in a perfectly dry place, and the insects should be left upon the boards for a varying length of time, depending upon the amount of moisture in the air, or upon the size of the insect. Large moths may possibly have to be left for two weeks, but butterflies will dry in a week, or less, and the other insects in about the same time.

Grasshoppers should have one pair of wings spread, and the other pair left in the natural closed condition. We have just said that the pin should be inserted through the middle of the thorax, midway between the wings, but there are some insects which should be pinned differently. Beetles, for example, should never have their wings spread, and should be pinned through the right wing cover, or elytron, the pin being inserted a little in advance of the middle of the wing cover and a little nearer the middle line of the body than the right margin. The true bugs should be pinned through the little triangular piece just behind the main part of the thorax.

Certain of the large moths, and many of the large grasshoppers, have such fat abdomens that they decompose, especially in a moist climate. Therefore, they must be stuffed, just as one stuffs birds or mammals. The lower part of the abdomen should be cut open, down through the third segment and, with a fine-pointed forceps, the intestines and other organs, and the fat, should be removed; the inside should be wiped out with a small wad of cotton and stuffed with cotton batting in short pieces, filling the body up through the opening. When the filling is completed, the edges of the severed segments are drawn together and the sides of the abdomen are pressed into shape with the fingers.

With the dragon flies, the body has a great tendency to break off, and this is prevented by inserting a long, stiff bristle clear through from the tip of the abdomen into the thorax.

The question of preserving the colors of dragon flies is a very difficult one. Nearly all of the most brilliantly colored ones become sordid and dull colored not long after death. Williamson has found that placing the specimens four hours in acetone, and then eight hours



in benzine, preserves the colors very well. He also finds that specimens which he first hardened in alcohol, and then placed for two days in benzine, also retained their colors fairly well.

The preservation of the early stages of insects is a rather difficult matter. Their liquid preservation will be referred to at the end of this article. But with the *larvæ* of butterflies and moths (caterpillars) a very good method, when performed by an expert, is to extract the body contents and inflate the skins. The caterpillar should first be killed by dipping in chloroform or alcohol, or by being placed in a cyanide bottle; then place it on a piece of blotting paper, press it slightly and cut the anal end of the body which slightly protrudes. Through this orifice squeeze out the entire contents of the body by rolling a pencil over it. This should be done gently, so as not to burst the skin in any other place, and so as not to squeeze out the coloring matter and render it too transparent. Then insert a fine glass tube in the orifice (or a straw may be used) and after letting it dry for a short time, the skin will adhere to the tube.

It is then put into a drying oven, consisting of a tin box with glass sides, under which is placed an alcohol lamp. Then the operator blows into the end of the tube, gradually filling out the skin with air (a bellows may be used for this purpose, or a small rubber bag inflated with air). The amount of air blown in is graduated by the operator, and after the skin is inflated it is allowed to dry in the heat, air being constantly supplied. Through an orifice in the oven the skin may be manipulated so that it is made to assume a life-like position. When quite dry, it is removed and then may be mounted on a covered copper wire, the wire being fastened to a bit of cork through which a pin is thrust, so that the specimen may be mounted in the regular insect collection.

If the operation has been partially unsuccessful, in that the skin has become too transparent, a little dry coloring matter of the natural color of the insect may be blown into the orifice, but the operator will soon learn to avoid this difficulty. There are many insects which are too small to be pinned. Some few of them are so small that they can only be mounted properly upon glass slides for the microscope. Others, while too large or too thick for this purpose, are yet too small to be pinned. The most satisfactory way of mounting insects of this size has been found to glue them upon little triangular cardboard tags. They are fastened to the tip of the triangle, the pin being thrust through the base. White or yellow shellac is used for the fastening.

Little beetles should be mounted on their bellies, the tip of the triangle being stuck to the right side about the middle of the body.

Other insects should be mounted upon the left side, with the back away from the pin. Punches for cutting these little triangular tags may be purchased from the dealers.

### LABELING

The matter of labeling is a very important one. Of course each specimen should carry a label bearing its name. All labels should be of small size, and should be pinned below the insect. No label borne on a pin in this way should be more than three-fourths of an inch long by three-eighths of an inch wide. It is better to have several labels than one very large one. With the name of the insect upon one label, the name of the collector should be written upon another one, even smaller, and the exact locality and date should be placed upon a third label.

The sequence of the labels upon the pin should be as follows: The insect at the top (one-quarter of the length of the pin from the top); the locality and date on a small label just beneath the insect; below that, the name of the collector upon another label, and at the bottom of the pin the name of the insect. To the name should be added the sex sign (♂ or ♀). The locality label should be very exact. It will not do to write simply "New York" or "Pennsylvania"; nor will it do to write "Otsego County, New York," or "Bucks County, Pa."; but it should be "Cooperstown, N. Y.," or "Doylestown, Pa." And even where the town is an insignificant one, it may be well to add the exact elevation at which the insect was collected. After the labeling is completed the insect is ready for the cabinet.

### THE CABINET

The cabinet to be used depends largely upon the taste or means of the collector. In the colder parts of the country, where museum pests and red ants are not abundant, many collectors keep their specimens in cork-lined cigar boxes. This however is dangerous, and further south a collection kept in this way is sure to be ruined. The so-called Schmidt insect box is excellent for a temporary collection, and many collections are contained wholly in these boxes, and often kept for many years. It is a very tight book-form, cork-lined box with a lip over which the hinged cover closes so tightly that there is no opportunity for a museum pest to enter. It is a good box for a working collection, since it is of convenient size, and the specimens are readily handled.

For a more permanent collection, a glass-covered tray, made as a sliding drawer to fit into the cabinet, is generally used. The joints of



the drawers should be made absolutely air tight, and the covers should fit in with corresponding tightness. Any good cabinetmaker can prepare such a cabinet, with the point of tightness borne constantly in mind. The standard tray used in the National Museum is one foot and four inches wide by one foot and six inches long, and three inches deep (all outside measurements). The bottoms are all lined with cork, over which white paper has been carefully and neatly pasted.

Napthaline placed in the Schmidt boxes, or in the drawers just described, will keep out insect pests, but where a collector exchanges with other collectors he may inadvertently secure specimens which are infested with *Anthrenus*, or something of the sort. It becomes desirable, therefore, to thoroughly disinfect a collection at intervals, and this may be done by pouring a small quantity of bisulphide of carbon into each box. It should be remembered that this substance is volatile, and that its vapor is inflammable. A friend of mine once lost his beard and eyebrows through stopping to light his pipe, while engaged in disinfecting his collection.

#### ALCOHOLIC SPECIMENS

Soft-bodied insects, and this includes the early stages of nearly all insects, must be kept in liquid—either alcohol or formalin, or Mueller's fluid, and even then there is considerable difficulty in preserving the colors of some of them. It is well to pass most of them through successive strengths of alcohol, beginning with fifty per cent and ending with ordinary commercial alcohol, sometimes having cut a small slit in the skin so as to allow the liquid to penetrate the body. Formalin in ten per cent solution answers for most of them, but the grubs of the large wood-boring beetles, and some of the grubs which live under the ground, discolor in either of these liquids—that is, they turn brown. Such objects will best be preserved by boiling them first in water. They should be boiled until they rise to the surface, when they should be immediately taken out and put into alcohol. They will then remain white and plump.

The permanent arrangement of alcohol specimens is very difficult. A vial tray in use by some collectors is a good idea, probably the best solution yet reached.

## INSECTS

THIS form of animal life is classified by zoologists into a group with the Lobsters, Crabs, Shrimps and Spiders, under the name of Anthropods, a term which means "jointed foot." All of these have several points of resemblance which are made the basis of classification. Among these it may be noticed that they are all symmetrical on both sides of a middle line passing through the length of the body. They are made up of a number of rings or scales, arranged in a series. The body is protected by a more or less horn-like outer covering, which is very thin, soft, and yielding in the young of these animals. This is by far the most numerous group in the animal kingdom as there are more representatives included under this head than are contained within the rest of the animal kingdom combined. Of the insects alone there are over 300,000 named species known to the zoologist, and this number does not represent one-tenth, or at most, one-fifth of the existing forms of insects, and in some of the species there are many millions of individuals, sometimes congregating in such masses as to darken the sky.

The body of an insect is divided into three sections: the head, the thorax and the abdomen. In some insects these three parts are very clearly defined; in others they are modified and frequently run together. The essential parts of the head are the eyes, the feelers, or antennæ, which are sometimes very long, and the mouth portion which sometimes consists of a sucking organ, or a piercing organ, or is adapted for biting and cutting. On the thorax are usually three pairs of legs, and sometimes one or two pairs of wings. It is not often that the abdomen has any appendages. The life of insects is one of great activity, and their bodies are often remarkably strong. The loads that Ants and Beetles can carry and the distance Fleas and other insects can jump are wonderful when their size is taken into consideration; and yet, they are well equipped for this work; for, while there are over 500 pairs of muscles in the human body to produce all its complex movements, many insects have over seven times that number. The amount of food which insects will devour in a day is simply marvelous, for they often consume many times their own size and weight of food in that time. They live upon the juices



of plants and animals, and sometimes upon firm tissues. Bees and Ants live longest of all Insects. A Queen Bee has attained an age of seven years. Some species of May-flies live for only twenty-four hours. It is known that some forms of these take a period of three years to reach the fly form and after they have reached this stage, they live for only a few days. The house-fly completes its full period of life from egg to death in a week during summer, but takes longer in cold weather. The blood of insects is a colorless fluid which circulates through every part of its body even to the thin membranous wings, being driven by a heart. The muscles are attached to the inside of the hard integument or covering and consist of fine fibers. Their number is very great and their strength wonderful. The method of increase is usually by eggs but some insects bring forth their young alive. The Arthropoda are classified as follows:—

- CLASS 1. Arachnida:—Spiders, Mites, Ticks, King Crab or Horseshoe Crab.
- CLASS 2. Insectæ.
- CLASS 3. Myriopoda:—Centipede, Thousand Legs.
- CLASS 4. Onychophora.
- CLASS 5. Crustacea.

## KING CRAB

THE King Crab is the most highly developed of the Arthropods. It belongs to the division of Arachnida, and may be found living at the bottom of the shallow waters all along the eastern coast of the United States. It has a very large round head and thorax, which is in the form of a horseshoe and the animal is sometimes called the Horseshoe Crab. The animal has four eyes, two on the curved surface in front, and two larger ones farther outward. It has six pairs of arms or legs with which it grasps its food and by which it moves. The breathing is carried on by means of a number of plates which are attached to the under side of the abdomen. A long spinous growth extends from the abdomen and looks like a long tail, and this plays an important part in the motion of the Crab.

## MITES AND TICKS

THESE are extremely small growths which are found on decaying vegetable matter, some in fresh water and some in the sea.

They frequently take up their abode on living animals and in this state are called parasites. The little scarlet specks seen running over stones in hot weather belong to this class. The red spider of the hot-house attaches its web to the leaves of plants upon which it feeds and often does much damage. The Cheese-mite is a fat bodied, colorless form with smooth skin and long hair. It breeds in great numbers in cheese, flour, and grain. Among the noxious forms are: the Tick, which is found infesting sheep; and the itch insect. The latter is a minute-bodied insect which is parasitic upon human beings. It burrows under the outer skin and causes intolerable itching as it eats its way along. It sometimes tunnels half an inch under the skin and lays its eggs in the tunnel. It multiplies very rapidly. It is a contagious disease and is probably best cured by sulphur ointment.

## SPIDERS AND SCORPIONS

YOU will find very much to interest you in watching the actions of some species of these curious little creatures. They are not so attractive as the pretty butterflies or moths, but their actions are often interesting, although they display what seems to you much cruelty in capturing their food.

The Spider is popularly supposed to be an insect, but this is not correct. He belongs to a class of animals known in science as the *Arthropoda*, and they differ from insects in a number of ways. An insect has six legs, while a Spider has eight; a Spider has no wings, while an insect usually has two or four; a Spider's body is usually divided into two parts, but there are three in the body of an insect; a Spider does not pass through different states, and you have already been told that insects pass through three, after leaving the eggs.

There are many kinds of Spiders and all of them spin some kind of web. You have seen these webs on bushes, on the ground, in the barn and even in the house. These webs are snares or traps to catch flies and other insects, which the Spider likes to eat. Spiders use this means because they have no wings, and would otherwise find it very difficult to obtain food. In some of the warm climates, Spiders have been known to spin such strong webs that little birds flying against them are entangled in the meshes and cannot get away. The web is composed of very delicate silken threads, which the Spider spins, but not in the same way that the caterpillar does. The Spider



has in the back part of the body a very curious organ called the spinneret, with which it spins its web. This organ is made of four or six knobs, and in each knob there are a thousand holes. Through these holes very fine silken threads pass out, more than four thousand at a time. At a little distance from the knobs, all these minute threads unite to form the thread which composes the web.

The silk comes from a sticky fluid contained in bags in the body of the Spider, and when the threads come out of the knobs they are soft, but they harden into silk as soon as the air touches them. You will be astonished to know what a great length of line some Spiders spin. An eminent scientist has told of a curious Spider found in South Carolina, which spins a line nearly two miles long in a few hours.

Some kinds of Spider have a silken den near their web, or in one part of it, in which they stay most of the time. From this den they have little lines to different parts of the web. When the quivering of these lines makes known to the Spider the presence of some insect in the web, he will dart out to the helpless little creature and by biting, poison it, so that it soon dies.

Near a Spider's web you may sometimes see little sacs, made of the finest, whitest, and most beautiful silk. If you examine them you will find them to contain the Spider's eggs. Some Spiders carry this egg sac about with them, while others spin it in a safe place and stay near to watch till the young are hatched, and then tear it open so that the young may crawl out. These little Spiders molt or cast off their skins several times before they attain their full size.

The House Spider spins its web in the corners of rooms. His webs have not the regular designs noticed in the webs of some Spiders, but are constructed quite irregularly.

Among the bushes in the garden, or in the open window in the barn or shed, you may have noticed a web formed in a very regular manner. It has lines running from the center, like the spokes in a wagon wheel, and these are joined by a line which the Spider starts at the center and carries round and round, till he reaches the outer ends of the spokes. At first sight, this line appears to be a series of circles, but it is really only one line.

The nest of the Trapdoor Spider is quite an ingenious affair. A full-sized nest is in the shape of a tube, about an inch in diameter, and extends into the ground a distance varying from seven or eight inches to a foot. This whole space is lined with beautiful silk, almost as thick as a piece of ordinary silk cloth. The mouth of the burrow, or nest, can be closed by means of a door, which is hung by a hinge of thick silk to the surface of the ground, and beveled around the

edges so that it fits into the mouth of the nest like a cork into a bottle. The inside of the door is covered with silk, but the outside is plastered over with dirt, so that when it is closed it can scarcely be seen that there is any difference between it and the surrounding soil. It is this marvelous little structure that has given the Trapdoor Spider its name.

Some of you might like to know the use which the Trapdoor Spider makes of this den. You know that Spiders, as well as other small creatures, have their enemies. Now suppose the Trapdoor Spider has gone out for a walk and is pursued by one of his enemies. He immediately seeks refuge in the burrow, pulls down its lid and hangs back downward, with all of its eight claws fastened upon the silk lining. Thus it holds its door tight against its assailants. The nest is also used as a trap to capture insects upon which the Spider feeds. Ants, beetles, grasshoppers or other insects which may pass near the opening and through curiosity peep in, are liable to be caught by the wise little Spider who has been lying in wait all the time for just such an opportunity.

Some, if not all, species of Trapdoor Spiders spin little webs near the opening of their nests. The feet of passing insects become entangled in these webs, and, before they can free themselves, the Spider darts out, seizes them and drags them into his nest. The Trapdoor Spider also spins a cocoon to contain her eggs in this nest. The cocoon is attached to the sides of the nest and swings like a hammock.

In sandy places in the country, you may frequently observe circular holes in the ground, which are sometimes large enough to admit a finger and which look as if they had been formed by thrusting a cane into the sand and then carefully withdrawing it. If you take a piece of grass and probe one of these holes, so as not to disturb the walls, it will usually be found to be about a foot deep. Just before your probe reaches the bottom, it may be vigorously seized, and by teasing you may entice the inhabitant half-way or more up the tube, but you will not be able to bring it into view.

If you scrape away the sand very carefully so as to expose the tube to its full length, you will probably unearth at the bottom a huge, fat Spider, guarding a silken bag of eggs nearly as large as itself. If the Spider is full-grown, its body will measure nearly an inch long, while its legs will cover a circle having a diameter of two and a half inches. This Spider is known as the Hermit of the Sands. The holes of these Spiders are always cylindrical, and very simple in construction. They are narrowest just below the mouth and gradually widen toward the bottom, where they are nearly twice as wide as at



the top. They are lined throughout with silk, to keep the particles of the wall from falling in, as the Spider clambers up and down, but the silk is so delicately woven, that it can be seen only by examination with a magnifying glass.

These Spiders live upon the juices of insects, which they capture by a rapid movement of the front legs and then thrust between their jaws. These insects are squeezed by the Spider's jaws until the juices ooze out, then turned over and squeezed again. This process is repeated until the juices are all extracted, and the carcass is finally dropped.

Although many stories concerning the Tarantula Spider have been proved false, a close acquaintance with him is attended with very unpleasant results. The sting of the Tarantula may not be deadly, but its bite will cause swelling and irritation. This has been proved by people allowing themselves to be bitten, to learn the resulting effects of such bites. This giant Spider is much larger than any that you have been accustomed to see. Its home is in the south of Europe, where it lives in the ground in holes four inches deep. To this nest the Tarantula carries its prey, as a lion would to its lair.

The Scorpion is a Spider-like animal, having a long body ending in a curved sting. This sting is hooked like a claw and is connected with a little bag of poison, so that it inflicts a poisoned wound. The sting of the Scorpion is exceedingly painful, and is said to paralyze the organs of speech. The Scorpion has also a large pair of nippers like the claws of a lobster, and in fact he very greatly resembles a little lobster.

Scorpions are found in warm countries, where they live under stones and in dark places; and sometimes you may see them in houses. The Scorpion runs very fast, bending the hind part of its long body in every direction, and striking this way and that, so as to wound whatever touches it. With its sting it kills locusts, beetles and other insects, which it catches by means of its "pinchers." The female Scorpion carries her young ones upon her back during the first few days of their life, and watches over them until they are able to take care of themselves.

Some people claim that Scorpions will not bear imprisonment, and that if one is shut in a box or glass vessel, as soon as it finds that it cannot get away, it stings itself to death. There are very many, however, who have studied the habits of this creature, who do not believe these stories.

## B E E S

THE busy little Honeybee, that flits about from flower to flower, sipping the nectar for its honey, is more useful to man than any other insect except the silkworm moth. There are many other varieties of Bee, but they are neither as useful nor as interesting as the Honeybee, and they are not so well worth study.

The Honeybee is probably the best known of the insects that live together in very large numbers, forming what are known as colonies. In a single hive there are thousands of these busy little creatures, and there are always three kinds of Bees in each hive, the Queen, the Males or Drones, and the Workers. The Queen is the largest of these and there is only one Queen in a hive. She is the mother and lays all of the eggs. She stays in the hive most of the time, and is fed and waited upon by the Workers. The Queen Bee lives four or five years, which is longer than the life of any other perfect insect. The Drones, of whom there are only a few in each hive, have no sting and do no work. The Workers are the smallest members of the community, and are the most numerous, there being thousands of them in each colony. They make the comb, fill it with the honey they have gathered from the flowers, feed and take care of the young Bees, and in fact, do all of the work. It is the Workers that you so often see flying about among flowers.

If you have ever seen a honeycomb, you probably know that it is made of wax, and that it consists of many little cells, each of which has six sides. It is a curious fact that the honey-cells are all the same size, whether they are made by Honeybees that live in our country or in countries thousands of miles away; whether made by tame Bees that live in hives or by the wild Bees that live in forests, having their nests and combs in hollow trees or in holes or crevices among the rocks. The bottom of the cell is made of three diamond-shaped pieces, being deepest in the center. The Bees begin their comb at the top of the hive and build downward. Each comb has two rows or tiers of cells, one row opening toward one side of the hive, while the other row opens toward the opposite side. When these cells have been filled, the tops are closed with wax, and the honey, being thus kept from the air, remains pure and sweet.

You have not yet heard how the wax is made, and it is worth knowing, for wax is a peculiar substance and is made in a very curious way. If you examine a Bee very carefully you will notice six little pockets on the under side of the body, and in these little pockets the wax is hidden in tiny scales. When Bees wish to produce wax, they must have plenty of food and warmth, and must then remain quiet



for at least a day; so the little wax-workers first eat all the sugar or honey they need, and then arrange themselves in the form of little curtains. They form the curtains by clinging one to another with the claws of their feet, while the first and last Bees attach themselves to some part of the hive or comb. In this way they hang until the wax is secreted, then they detach themselves, and by means of the pincers of their legs they remove the little scales of wax from the pockets.

The Bees mold and work the scales with their heads and tongues, softening them with a liquid from their mouths. When the wax is warm, it is soft and can be easily molded into any form, but as soon as it gets cold, it is hard and firm, and the texture is so very close that not a particle of the honey can soak through, although the walls of the cells are very thin.

Bees collect from the poplar, birch, willow, and other trees, that from which they form a substance called "Propolis." This is harder and firmer than wax, and the Bees use it to strengthen the cells, or to fasten the combs to the top of the hive. Sometimes it is used for closing up cracks and holes in the hive, in order to keep out the rain, or to prevent the entrance of insects or snails. Another substance that is found in Bee-hives is known as Bee-bread. This is made by mixing together honey and pollen, which is a bright-yellow dust that the Bees gather from flowers. Bee-bread is used principally for feeding young Bees.

Perhaps you would like to know something about the young Bees. As you have already learned, the eggs, from which the Bees are hatched, are all laid by the Queen. She deposits them in the cells of the honey-comb, one egg in each cell. After a few days, the eggs hatch into little soft, white creatures that look like worms. These are known as *larvæ*, and they are fed and cared for by the Workers. After five or six days, the Workers close the tops of the cells, shutting the *larvæ* inside. Each *larva* then begins to spin for itself a silken covering or cocoon, which it completes in one or two days. Within this covering, the young Bee remains for a week or more, gradually changing its form. When it is fully developed, the young Bee bites a hole in the top of the cell, slips out of its cocoon, and emerges a perfect Bee. If it is a Worker, it will soon be winging its way over the fields in search of honey.

The young Queens are not treated in the same way that young Workers are. Their cells are larger and they are fed on a better kind of food, which is known as royal paste. This causes them to develop fully and become Queens, instead of remaining undeveloped, as the Workers are.

In each hive there are always several Queen cells, and just before the oldest of the young Queens is fully grown, the Queen mother leaves the hive, or nest, with a portion of the Workers and Drones, and sets out to form a new hive. This is called swarming, and when it occurs, the owners of the Bees, and others, rush wildly about, ringing bells, striking tin pans and making other strange noises, in their endeavors to cause the Queen Bee to alight, for when the Queen alights, the other Bees cluster around her in a ball, and they can then be captured and put into a new hive.

After the old Queen is gone, the young Queen comes out of the hive and takes what is called her marriage flight, after which she returns and kills any little Queen Bees that may still be in their cells. She then rules in place of her Queen Mother. If she does not succeed in killing the little Queen Bees, she gets together her followers, as her mother did before, and goes to establish a new hive.

On very warm days in summer, you may have seen rows of bees just in front of the entrances to their hives, swiftly moving their wings, as if they were fanning. Had you looked inside the entrance, you would have seen other Bees doing the same thing. The air inside the hive is always warm, and in order to lessen the heat and keep the air pure, the Bees resort to the action which you have seen. The Bees in the different rows all fan in the same direction, so that currents of cool, fresh air are always passing in, and the warmer air is passing out. If it were not for this, the air in the hive would get so heated that the wax would soften and the combs fall. This does happen sometimes, in spite of all that the Bees may do to keep the hive cool. At such times, it is well to keep away from the hive, for the Bees are very angry and are liable to sting any one who comes near.

There are many persons who are afraid to go near a Bee lest it may sting them, but this only shows their ignorance of the habits of this marvelous little creature. A Bee will sting in defense of its home or life, or when it is angry, but ordinarily it is as harmless as a fly. If you see a bee working on a flower, put your hand over it in such a way as to form a kind of little box, inclosing it without pinching it. It will try every means to get away, but will not offer to sting.

Whether you can go near a hive in perfect safety, depends on various circumstances. Bees of different colonies have different dispositions. The Bees of some colonies are so ill-natured that they will fly out and sting any one who comes near the hive. Others are so gentle that you might sit near their hives and watch them by the hour, without any fear whatever. Bees that are very gentle while gathering honey during the summer may be somewhat more inclined



to sting in the fall, when their hives are filled with stores, and they are constantly irritated by the attempts of robber Bees to break into their well-filled larders. A robber Bee is one who has formed the habit of stealing, instead of working to procure its food. In this it resembles some men who prefer to steal the goods of others rather than to perform honest labor. It is astonishing to see how these robber Bees are able to keep from being caught.

If you have ever been stung by a Bee, you may have noticed sticking in the skin an innocent-looking little thing having the appearance of a slender thorn, about an eighth of an inch long. This is the Bee's sting. It consists of a hollow, sharp-pointed tube, within which are two very minute darts which are hooked at the end. The tube or sheath connects with a bag of poison within the body of the Bee. When the Bee wishes to sting anything, it first thrusts in the sheath or tube, then the darts are pushed through the sheath and the poison flows into the wound thus made.

People often talk of the wonderful industry of the Honey-Bee, but you will be very much surprised to know the great amount of labor it really has to perform in gathering and storing its honey. Experiments have shown that a red clover blossom contains less than one eighth of a grain of sugar. Now there are seven thousand grains in a pound, so a bee that makes a pound of honey must get the material from about fifty-six thousand clover blossoms. In order to get the nectar from the clover, it has to insert its proboscis, or long mouth, through which it sips the nectar, into each little floret composing the head of clover, and there are about sixty florets in every head. The little Bee therefore, must perform this operation sixty times fifty-six thousand, or three million, three hundred and sixty thousand times, in order to obtain a pound of nectar from the clover.

Bees are useful to farmers in another way, for many farmers can tell, from their habits, whether there will soon be rain. A Bee never gets wet, for he "has enough sense to come in out of the rain." If a shower is near, the Bee never goes far from home in his search for honey, but gathers it from plants or trees near the hive; or if there is none near, he rests from his labors for the time. When the Bees are very busy early in the morning, it is a sign that there will be rain before the close of the day.

Boys who live in the country know what it is to hunt for the nests of the Bumble-bee. These Bees build their nests in the ground, or under stones, or in little nests of grass that field mice have made and left.

The Bumble-bees are much larger than the Honey-bees, but they do not live together in such large numbers. In some nests there are

not more than fifty or sixty Bees, but sometimes there are as many as three hundred, or even four hundred, in the same colony. Four kinds of Bumble-bees are found in each nest, the large females or Queens, the males, the workers, and the small females. Only the large females live through the winter; the others die in the autumn. During the winter, each large female crawls into some sheltered spot under a stone or stump, or among dry leaves, and sleeps until the coming of the warm spring days, when she comes forth from her hiding-place and goes in search of a place to make her nest.

When she has found a place suitable for a nest, the Bumble-bee begins to collect pollen and honey, which she brings to her nest and forms into a little mass, in which she lays several eggs. In a few days these eggs hatch into little worms that feed upon the pollen and grow rapidly. When these little worms, or *larvæ*, attain their full size, each spins around itself a silken cocoon, which the old Bee covers with wax. In these cells they remain until they become perfect Bees, when they bite their way out. While these little Bees have been growing, the old Bee has gathered other masses of pollen and honey, in which she has laid more eggs, so that little broods of Bees are hatching out every week or two. The first broods are all workers, who assist in building new cells and in feeding the young that develop from other eggs, laid by the large female, or Queen. The small females and males are produced about the middle of summer, and from the last eggs that are laid come the Queens, who live through the winter and found new colonies the next spring.

There are other species of the Bee, with which you are not so familiar. These do not live in families, like the Honey-bees or Bumble-bees, but live alone, each making her own nest. These Bees are called Solitary Bees, to distinguish them from the Bees that live in families and are known as the Social Bees. One kind of Solitary Bee is called the Carpenter Bee, because she bores into wood, to make her nest. The Carpenter Bee has strong jaws, with which she bites out the wood, making a hole that is sometimes a foot or more in length. When the hole is made deep enough, she begins to collect honey and pollen, which she deposits in the hole. She then lays an egg and covers it with little bits of wood and dust, which she glues together with a sticky fluid from her body. She then gathers more pollen and honey and lays another egg, which is covered like the first. She keeps doing this until the entire tube has been filled with eggs, inclosed in separate cells. When the eggs begin to hatch, those in the lowest cells hatch first, and the young Bees must have some way to get out. This is foreseen by the mother Bee, for she makes a side opening near the bottom of the tube, and fills it with a dust paste. Through



this paste the first, or lowest, Bee gnaws as soon as it is full-grown, and the others follow in their turn.

Another Bee whose operations are quite interesting, is the Leaf-cutter or Tailor-bee. This insect drills in a sand bank a hole about ten inches deep and a half-inch in diameter. She then fills this with cells formed of pieces of leaf, cut into proper shape and neatly fitted together. The six legs hold the leaf in position while her jaws cut out the piece more evenly than can be done with a pair of scissors. Some of the cut pieces are perfect circles; others are oblong figures of different sizes. In a few seconds, the Bee cuts out a piece such as she needs, and then flies away, carrying it with her hind legs. As soon as the cell is done, the Bee fills it with pollen and honey, lays a single egg in it, closes the top, and then begins another cell. A single Leaf-cutter sometimes makes as many as thirty cells in one season. The egg soon hatches, and when the little *larva* has grown to its full size, it spins a silken case within its leafy cell, and soon develops into a perfect Bee, which bites its way out. Another kind of Bee makes her cells of mud or little grains of sand cemented together. For this reason she is called the Mason-bee.

## WASPS AND HORNETS

WASPS and Hornets belong to the same family as do the bees, but they are neither so familiar nor so useful to mankind, as are their busy little cousins. The Hornet is, really, only a large brother of the Wasp, for the two insects belong to the same genus, and their habits are much the same, the principal differences between them being in size and strength. We seldom have an opportunity to become acquainted with them, for the mere presence of any other creature seems to anger them, and their sting is not only painful, but sometimes dangerous.

These insects do not obtain their food by supping the sweet juices of flowers, but prey upon smaller insects, such as spiders, flies, and caterpillars. Although some Wasps live alone, like the Carpenter-bee and the Mason-bee, the greater number live together in large families. Most varieties, including the Solitary Wasps, live in holes, which they dig for themselves in the ground, while others build nests in the trees or bushes, or on fences or buildings.

Have you ever seen a Wasp's nest? If you have you may remember that it is a curious-looking object, and that it appears to be made of grayish-colored paper. The material really is a sort of paper that the Wasps have made out of woody substance collected from leaves

or weather-beaten boards. As these insects have always made their homes in this way, they can lay claim to being the first paper-makers in the world.

The queen starts the nest, and makes a few cells by gnawing the little woody fibers and softening them with her jaws into a kind of paste that soon hardens. In each cell she deposits an egg, from which are hatched small, white, footless worms or grubs. These little grubs are fed upon insects, which have been finely chewed by the mother Wasp. In a very short time the grub changes into the dead-looking chrysalis or *pupa*, and a little later, it emerges as a Wasp that is like the queen, but much smaller. These little insects, developed first, are the workers of the colony, and they now assume most of the labors of building the nest and caring for the young. The next duty of the queen is to deposit an egg in each new cell, as fast as the workers get it ready.

If you watch the building of these cells through the summer, you will notice that toward the close of the season the cells are much larger. The reason for this is not immediately apparent, but when you see the insects that develop from the later eggs, you will notice that they are larger than those that you first saw. Some of these are the male Wasps, while others are females or queens. When cold weather sets in, the males and workers perish, but the females crawl into sheltered nooks in trees, fences, or buildings, and there remain through the winter. The next spring, they found other colonies in the manner that has just been described.

The White-faced Hornet is one of the most familiar members of the Wasp family, and his sting is the most dangerous of all. He is one of the largest of the family, and his habits and appearance are as familiar to most of us as are those of any other variety. His body is black, ornamented with white stripes. His principal food is insects, which he often devours while he is hanging suspended by one leg from a twig or other support. A species of the Wasp family that is more common than the White-faced Hornet is the Black and Brown Wasp. His nest is usually found under the gables of houses or the roofs of piazzas, in board piles, or sometimes even under stones. It has no paper covering, but depends upon its situation for protection from the weather.

The life history of this Wasp is very similar in its general features to that of the Hornet. The females live in some sheltered spot during the winter, and in the spring they form cells and lay their eggs. From these are hatched the workers, which give the female assistance in building new cells, and in feeding and tending the young that are hatched later.



Did you ever see a Mud Wasp building its nest? It is a very curious as well as a remarkable operation. If you watch carefully, you will see the little insect carrying in her jaws pieces of mud, which she uses in building her nest. The little creature shapes this nest very neatly into a single cell, and after depositing an egg in it, puts in a number of insects to serve as food for the young Wasp when it hatches. The top is then closed with mud, and if a piece is broken off the nest before the egg hatches, the mother immediately repairs it in a very dexterous manner.

The clay banks of streams are favorite sites for the nests of Mud Wasps, and some farmers watch the position of these nests in order to form an opinion as to the kind of weather that will prevail during the season. If the nests are down near the level of the water, the farmers regard it as an indication that the season will be dry, but should the nests be built high up on the bank, they accept it as a sign that the season will be wet, for these insects are careful to place their habitations where they will be safe from floods. A species of Mud Wasp fastens a little round nest of mud to stems of plants. In it the eggs are laid and a supply of insects is conveniently placed for food for the young when hatched.

## ANTS

YOU have been told of the almost human intelligence displayed by the bees, in building their nests, caring for their young, gathering food supplies, and so on; but Ants show even more intelligence in their actions than do bees. From ancient times the wisdom of the Ant has been proverbial. It is true that Ants are not useful to man, at least their usefulness is not apparent, for in most cases they are really a pest. Yet they form a very interesting subject for study, and many facts that show their great intelligence have been observed by persons who have studied their actions. In a community of 500,000, every Ant recognizes his fellow-citizen; they keep herds of insect-cattle; capture and train slaves; form cities with tunnels, chambers, roads and bridges; they are aware, beforehand, of seasons, and store food for the winter; they carry on wars, and are perfectly loyal in sustaining their ruler.

An Ant colony always contains at least three forms of Ants: the winged males, females who possess wings in the pairing season only, and the workers. This life history of the Ant varies in the different varieties, but in the average colony it may be described thus: Sometime during the summer, the males and females attain their full

growth, and soon they take what is called their marriage flight. The males die shortly after this, and the females attend to the raising of their brood. At times, the females form new colonies by themselves, or with the assistance of some workers from the parent colony. Usually a sufficient number of females is forcibly retained by the workers of the original colony to keep the community strong and vigorous.

The newly-laid eggs, which are very minute, whitish, oval objects, are exposed to the morning sun, covered from its heat during mid-day, and removed from the influence of the damp and cold at night. These eggs must be nursed into *larvæ* by having the surface licked, and you may have noticed the workers, old and young, standing for hours around the eggs performing this service.

The eggs hatch, within about a fortnight, into the *larvæ* or grubs. These grubs, which are very much like barley-corns in appearance, are frequently mistaken for eggs. They are fed with a liquid disgorged from the stomachs of the workers or nurses. The *larvæ* spin cocoons about themselves, and so pass into the *pupa* state. The workers are very careful to keep the *pupæ* warm, moist, and clean, and when the Ants are ready to emerge, the workers help them out by biting the cocoons. The little new-born Ant comes forth wearing a thin membranous covering over his body, like a shirt, which is tenderly removed and the baby Ant is then washed and fed.

Until their skins harden, the young insects are led about the Ant city and taught the duties that will afterward be expected of them. When their skins have hardened, they are sent forth to fight, or to do their share in bringing back food. They are taught not only to recognize every member of their own very crowded community, but to know their *pupæ* from those of a strange colony, which you would take to be exactly the same. That the Ants do recognize their own *pupæ* is very apparent, for if you place a stranger among them, even one of the same species, it will be attacked and driven out of the nest.

If you ever have the opportunity to watch a colony of Ants closely, you will find it extremely interesting to see the workers bringing the ant-babies into the presence of the queen, as if for a royal inspection. One thing that will surprise you is that all the worker-ants, or nurses, stand facing "Her Majesty," and an eminent scientist, who has made an especial study of these little insects, tells us that they never turn their backs to her, if that discourtesy can be avoided.

Probably the commonest Ant found in houses is that most annoying of pests, the Little Red Ant. The other species, commonly found in houses, are the Little Black Ant and one known as the Pavement Ant. These Ants are not very destructive to household supplies, but



they are annoying, from the mere fact that they are continually getting into articles of food, particularly sugars, syrups and other sweets.

The Red Ant builds its nest in the walls, or beneath the flooring. It passes its entire existence in houses, never being found in colonies out of doors. As these little creatures prove so very troublesome, probably you would like to know a method of getting rid of them. To do this, you must first locate the nest by following the workers back to their point of entrance. If you find that the Ant colonies are in the walls, you may destroy them by injecting into them bisulphide of carbon or a little kerosene. If under flooring, it may sometimes be possible to get at them by taking up a section of it. If you do not find the colony and destroy it completely, your efforts will do but little good.

The Little Black Ant is sometimes found indoors, where it may become very troublesome, but its colonies are usually found under stones in yards, or in the fields, where you may recognize them by the little pyramids, composed of fine grains of soil, that surround the entrances to the excavations. If you uncover one of these Ant colonies, you will find it to contain workers, and usually one or more Queen Ants.

The Pavement Ant is black, and two or three times as large as either of the two species that have been described. It is not so common in the West as in the eastern and central parts of this country. In Europe it is the Common Meadow Ant. Its colonies are usually found under pavements, or beneath flagging, or other stones, in yards. Frequently it proves a more persistent and pestilent house nuisance than the true house Ant.

Under rotting boards or in decaying stumps, you may find colonies of White Ants. In these you will find workers, young Ants in various forms, and, if it is in the spring, the winged males and females, which fly out about this time to form new colonies. Each colony also contains a single specially developed parent pair, called the king and queen. The soldiers or workers of this species are undeveloped insects of both sexes. In this respect, they differ from other species, in which the workers are all undeveloped females.

The development of these curious insects is very simple, the change from the young *larva* to the adult being gradual and unaccompanied by any marked changes in structure. They feed on decaying wood or vegetable matter of any sort, and are able to carry their excavations into any moist timbers, or into furniture, books or papers stored in rooms that are at all moist. Their chief food is the finely divided material into which they bore. They also devour the superfluous members of the colony and consume all dead individuals, cast-

off skins and other refuse material. They are capable of exuding a sort of nectar, which is used to feed the young and the royal pair.

All, except the winged or migrating forms of this species, are incapable of enduring full sunlight, and the soft, delicate bodies of the workers, soldiers and young Ants shrivel rapidly when exposed to it. The workers attend to all the duties of the colony, make the excavations, build the nests, care for the young and attend to the wants of the queen. They are assisted somewhat by the soldiers, whose duties are chiefly protective, their enormous development of head and jaws indicating their position as fighters or defenders of the colony. Some of these fighters have long beaks, from which they eject an acrid, corrosive fluid; others inspire terror by making a loud, clicking noise with their mandibles, or jaws, but they can neither shoot nor bite. It is a very singular fact that these soldier Ants do not return to the nest, after rushing forth to defend it, but wander about and soon perish from exposure in the outside air.

In all their operations, the White Ants conceal themselves very carefully, and in mining timbers, or books and papers, they always leave the surface intact. In this way the damage which they are doing is often entirely hidden, and the injury is not recognized until the furniture breaks, or the underpinning and timbers of houses or floors give way. If you should notice the swarming of the winged members of this species in the early summer, an immediate investigation should be made, in order to discover any harm that has already been done and to prevent serious damage later.

The point from which the winged insects emerge usually indicates, quite accurately, the location of the colony, and if it can be reached by removing the flooring or opening the walls, the colony may be destroyed by a thorough drenching with steam or hot water, or, better still, with kerosene or some other petroleum oil. The destruction of the winged insects as they emerge from the colony is of no value whatever; the colony itself must be reached, or future damage will not be interfered with in the least. If the colony can not be completely exposed, it may be possible to destroy it by injecting kerosene, in sufficient quantity, into the crevices from which the winged Ants are emerging. In cold climates these Ants do very little harm, but in the South they often cause great damage, and frequent examination of libraries and stored papers are rendered necessary.

An Ant whose operations are very curious and whose appearance is quite comical, is one that is variously called the Parasol Ant, the Leaf-cutting Ant and the Farmer Ant. He is a little, red insect, usually seen carrying a piece of green leaf over his head like a



parasol. He is not carrying the leaf as a protection from the sun, however, but to form a soil upon which to raise his crops.

This Ant, less than half an inch in length, is found in the West Indian island of Trinidad. His nest is a mound of reddish-brown earth, thirty feet in circumference and three feet in height. Branching from it in all directions are small highways, three inches wide, hard, well attended to, and extending for miles through the forest.

When a new colony leaves an overcrowded parent city and sets up for itself, it is very careful in its choice of a new home. It must be on a gentle slope or a hillside, so that the rain will drain away easily and not leave the city damp; it must be near a pool, or stream of some sort, so that water will be at hand for farming purposes, for you must remember that these are Farmer Ants; then it must be at the foot of a tree; and, above all, it must be in a place where there is such food as the Ants need.

The place for the city having been found, each Ant goes to work. Grass is cut, sticks and leaves are cleared away, pebbles are rolled aside and digging is begun. Round chambers are hollowed out, each about three inches wide. These chambers have good, thick walls, so that they will not cave in during wet weather, and each opens into the main street, which is an arched passageway, an inch high and three inches wide. This passage inclines down hill and has an opening at either end. The lower opening is for removing refuse, and the one at the upper end is for the workers who bring home the leaves.

The clay that is taken out in digging the chambers is carried out and piled in a mound, on top of the city. As the colony increases, more chambers and passages are dug and the mound on top continues to grow larger.

The eggs laid by the queen are hatched and the baby Ants cared for by the workers, in much the same manner as those of other Ants, but the manner in which the Ants obtain food is unique and interesting. Each colony has its farmer-inspectors whose duty it is to look out for food. When they discover a nice young orange or cocoa tree full of new leaves, the inspectors hurry back to the city and lead out several thousand workers to carry the food to the colony. They approach as near to the tree as they can by their own highway, and when it becomes necessary to leave the beaten road, a gang sets to work to clear a temporary path to the tree, which the other gang begins to climb at once.

The farmer-inspectors lead the workers out to the farthest twigs, where they cut pieces out of the leaves, and, tossing these over their shoulders, they start back to the city. Soon a steady stream of

Farmer Ants is passing into and out of the city, and the tree is quickly stripped of every tender bit of green.

When the workers come in and deposit the bits of leaf in the little chambers of the city, other Ants take them up, cut them into smaller bits, moisten and knead them and pack them down. In this way a soil is formed for the growth of a kind of fungus which looks like a delicate fur. The fungus, which grows over the bits of leaves in a few days, is probably the most delicious food that the Ants obtain, and on it they feed and grow fat.

One of the most interesting sights that may be seen by an observer of Ants is an Ant-battle. The Parasol Ants have deadly enemies in the Hunter Ants, who live in the holes of dead trees. These Ants pounce upon the little Parasol Ants and tear them to pieces. Sometimes these savage Ants collect under one leader and set out upon a raid. Upon these raids they kill in their line of march, not only small insects, but young birds in the nest, young field mice, toads, lizards, snakes, scorpions, cockroaches, crickets, spiders and locusts. When the Farmer Ants hear of their onslaughts, they hasten home to give warning and get under cover. Soldiers are then posted at every entrance to the city, and when the savage Hunter Ants pour down upon it, they are met by the resolute fighters, who seize them with their scissors-like jaws, and, though stung to their vitals by the sword-shaped, poisoned stings of the Hunter Ants, they slice away at their throats until they fairly cut their heads from their bodies.

When the Hunters have been driven off, the soldiers lie down and lick their wounds, while the police Ants come out and gather the dead, and carry them to the cemetery, for there is always a small space near one of these cities, where the Ants bury their dead. Ants have funeral ceremonies that are very similar to those of human beings. Here is an account of an Ant funeral that was actually observed:—

About thirty of the surviving friends of the Ant gathered around the dead Ant and two of them lifted the body and bore it to the cemetery, while the others followed in procession. When the burial place had been reached, the Ants scratched a little hole in the earth, put the body of their dead comrade into it and covered it over. Afterward they returned in procession to the Ant city. While they always bury their own dead, these Ants never bury strangers, but devour their bodies instead.



## BUTTERFLIES

IN MANY respects, Butterflies may be compared to flowers, for not only do they vary greatly in both form and color, but they grow from tiny, bud-like eggs to full-blown insects, whose gay colors adorn the plants and shrubs upon which they alight. No other insect has greater beauty than the Butterfly, and no other attracts so much attention from the children, who never seem to tire of watching a Butterfly, as he flutters from flower to flower.

Nearly everyone has seen caterpillars, but there may be some persons who do not know that these queer, hairy creatures come forth from the eggs of Butterflies, and that the caterpillars themselves finally develop into those fragile winged insects.

The life history of the Butterfly is perhaps the most interesting thing about him, for he exists at different times, in forms so different, that they may be considered distinct creatures. After leaving the egg, he develops into a caterpillar, then into a chrysalis, and finally into a Butterfly. The eggs, themselves, are an interesting subject for study, and it is well worth your while to learn something about them, for there are many kinds that vary greatly in color, form, and structure. There are almost as many varieties of eggs as there are classes of Butterflies. Those of you who have seen the eggs of the Butterfly on a cabbage leaf, or turnip plant, or on any of the different kinds of leaves on which the young caterpillar likes to feed, will remember that the eggs are very small, being scarcely as large as the head of an ordinary pin. For this reason it is necessary to study them under a magnifying glass in order to learn much about their structure.

The eggs of the Little Butterfly are perhaps the most beautiful. They are so small that fifty of them placed in a row would occupy a space of little more than an inch. They look like a Turk's turban, are carved very prettily, and have projecting knobs that are connected by low ridges, so that the surface is broken into many little cells. In color they are pale green.

The eggs of the Yellow Butterfly, that you see throughout the summer, are quite different. They are shaped like a full bobbin and both ends are bluntly rounded. On the sides are very delicate, raised lines, across which are still finer ones, that form with the others very small, four-sided cells. These eggs may often be found standing on end on clover leaves.

Besides these forms there are eggs of a sugar-loaf shape, some that are hemispherical, and others that are nearly globular; but most

of them are smaller at one end than at the other. Some are carved differently on their upper and lower halves, and in others one half appears to be smooth, but when looked at through a strong magnifying glass, a slight network is seen which is formed by very fine lines or veins. The colors of the eggs vary with the changes that take place in their contents. These changes can often be seen through the very thin shell. In this way an egg sometimes becomes salmon-colored, or purple, or even blood-red.

Butterflies have very different ways of laying their eggs. Some butterflies lay them in a mass; others, very neatly in rows. Another kind encircles a leaf very prettily with her eggs; while still another kind deposits her eggs very carefully in the form of a hanging column on the under side of a leaf. One of these columns sometimes contains as many as ten eggs. Most butterflies, however, lay their eggs singly.

It is from these eggs, as you have been told, that the crawling caterpillars come. You have doubtless seen caterpillars of many different sizes and colors, some on the plants in the garden, others on the leaves of trees, and still others crawling along the ground. It is very interesting to observe the growth and development of these caterpillars. Take, for example, the little caterpillar that you can find almost any day in summer, on the leaves of the celery, parsnip, or carrot in the garden. It is a bright-green color, with bands of black and yellow. It feeds on the leaves of the parsnip, or carrot, for from twenty to thirty days, during which period it changes its skin several times, each time gaining weight and brilliancy. The increase in size of the Butterfly is completed in the caterpillar stage, and when the caterpillar has obtained its full growth, you will find that it disappears from the leaves on which it has been feeding.

After abandoning the leaf, it crawls away to some sheltered spot, perhaps the side of a building or a fence, or the trunk of a tree, and there prepares itself for the change to the chrysalis state. To do this, the caterpillar first spins a small tuft of silk which it secures to the surface that it has selected for its home. It then fixes the little claws of its hind feet in this tuft, and spins a great number of tiny threads, which it fastens at both ends to the surface on which it is spinning in such a way as to form a U-shaped loop. When it has made this loop strong enough, it gradually works its way under it until the loop supports its body near the middle. The little creature is now secured in such a way as to prevent its falling, and in a few hours its caterpillar skin bursts open and falls off. This leaves the insect suspended in the chrysalis form.

The chrysalis is a dull brown, scaly-looking object, rounded at one end and pointed at the other, and has no legs. It eats no food, and



except for a very slight movement when touched, appears to be dead. If you look closely, you will notice what appear to be folded wings on the chrysalis, but they are only the cases that contain the real wings. Within the apparently dead chrysalis a complete change takes place, and the body of the caterpillar is gradually changed into that of a Butterfly. Ten of the sixteen legs of the caterpillar disappear, leaving six legs for the Butterfly, and a set of wings is added. In from twelve to fourteen days the chrysalis skin bursts open on the back, and the Butterfly comes forth. At first it is weak and clings to the empty shell of its old home. Its wings and legs are soft and useless. The little body soon grows stronger, however; the wings expand, and with them the beautiful creature flies away, tempting us to follow in order to examine it more closely.

The Butterfly that emerges from the chrysalis bears little resemblance to the caterpillar that crawls over the parsnip plants. It is now black, with yellow, blue, and orange, spots. It flies about from leaf to leaf, and from flower to flower, and after a while lays its eggs on those plants that the caterpillar likes to eat, so that the little caterpillars will find plenty of food as soon as hatched. By the time this second brood of caterpillars has gone into the chrysalis form, it is late in the fall. They remain in that form through the winter and do not come forth as Butterflies until the next summer.

The Butterfly that you have been watching is commonly called the Asterias. It is one of the most abundant of the variety known as swallowtails,—so called because its wings end in a sharp tip, like the tail-feathers of a swallow.

Several varieties of the Butterflies of this country may be seen as early as May, and sometimes as late as early October. Many of them remain until frost comes, and the largest Butterfly, the Archippus, does not appear until the middle of July, but it remains floating and circling on the wing until October. As roses belong to June, and chrysanthemums to November, so butterflies seem to belong especially to July. It is their gala month and they are seen everywhere, fluttering gaily among the shrubs and flowers. Butterflies are most abundant in July, but their lives extend into many of the other months, and occasionally they live through the winter, if they find some sheltered place in which they can remain in a state of insensibility until spring. Few varieties, however, live throughout the winter, and these, as a rule, only in warm climates. Nearly all of the Butterflies that you see in the spring are either developed from the eggs laid at the end of the previous summer, or from chrysalids which the warmth of the spring sun wakens from their slumbers.

There are many varieties of the Butterfly found in all parts of the

globe, and the blending of colors in some of them is very beautiful. Heavy black alternates with brilliant crimson, yellow, and gold; and shades of green and blue with deep, rich garnet and purple. Sometimes we see them marked with glowing colors in broad bands and blotches, and sometimes the colors form patterns of great delicacy.

A very remarkable thing that you may learn in the study of Butterflies is the wonderful way in which they are protected from their natural enemies, the birds. The Leaf Butterfly, a native of India, has wings, the upper sides of which are brilliantly colored, while the under sides are a dull brown. The value of this is not seen until the insect alights and closes its wings over its back. In this position it has the exact appearance of a dead leaf, in both shape and color.

The under sides of the wings of the most brilliantly-colored species of Butterflies are of some dull color, except in the cases of those that ordinarily carry their wings erect, and droop them when they alight. In these varieties the brilliant coloring is on the under side of the wing, and the dull color on the upper side.

#### THE YELLOW AND BLACK OR TURNUS BUTTERFLY

Do you remember a large yellow and black Butterfly that may be seen in the warm, sunny days of June and July? It is known as the Yellow and Black or Turnus Butterfly, and is one of the largest in our country. At times you will see it flying very high in the air, even over houses and the tops of tall trees, and at some distance it may be mistaken for a small bird. When this Butterfly was a caterpillar, it lived in an apple or wild-cherry tree, feeding upon its leaves. The caterpillar is green, with rows of blue dots, and yellow and black marks, and its head and legs are pink. This little fellow has a curious way of hiding himself. He spins a web of silk on the upper part of the leaf, then folds the edges over his body and fastens them with silken threads, thus making a case for himself. Early in the month of August, this caterpillar becomes a chrysalis, and the next summer you find that it has become a Butterfly. The Yellow and Black Butterfly is another variety of swallowtail.

#### WHITE BUTTERFLY

This is a beautiful Butterfly that is often seen near growing radishes, turnips, or, more commonly, hovering over a cabbage bed. When it lays its eggs it fastens them to the under side of the leaves, a few on each leaf. The caterpillar that hatches from these eggs,



you probably know as the green cabbage worm, but it is not a worm at all, for butterflies do not develop from worms. When fully grown, it is about an inch long and is half as thick as a common lead pencil. It prepares itself for the chrysalis stage in the same manner that the *Asterias* does, and remains in this state about eleven days, before coming forth as the pretty White Butterfly.

#### COLIAS, OR COMMON YELLOW BUTTERFLY

From early spring until June, and again, from about the first of August until late in the fall, another variety of butterfly is seen even more commonly than the white one that has just been described. This is the *Colias*, or common Yellow Butterfly. You will find it in the fields or by the roadside, and sometimes many of them may be seen sitting around a pool of water in the street. The caterpillars from which these Butterflies develop are green. They may be found near growing clover, the leaves of which form their principal food. This Yellow Butterfly and the white one just described do not have their wings extended into a sort of tail, but, like those of many other varieties, their wings are rounded.

#### THE BUCKEYE

The Buckeye Butterfly is found in almost all parts of the world. The upper surfaces of its wings are brown, marked with orange patches and with peacock-eye spots. It lays its eggs on the under side of the leaves on which it feeds, and they hatch out in four days. The caterpillar is dark gray, with broken stripes of pale yellow at the sides, and is flecked and dotted with orange. It has been found that the chrysalis hangs from seven to seventeen days, according to the season. This Butterfly may be looked for in the open country, especially where there are flowers of the golden rod, of which it is very fond.

It has probably never occurred to you that Butterflies bathe, but such nevertheless, seems to be the case, at least with a variety that is common in Australia. Butterflies are frequently observed to suck up moisture around the edges of pools, but those of the Australian variety are the only ones that have actually been seen to enter the water. They do this by alighting close to the water, and then backing into it until the whole body and the lower part of the wings are below the surface. The two fore legs are not submerged, but retain a hold on the land. While in the water, the fluttering of the wings ceases and they seem to enjoy their bath greatly. They remain in

the water for something like half a minute, after which they fly up again, apparently much refreshed. It is probable that the heat of the weather drives them to the water, just as it does many birds and animals.

If you wish to learn something about Butterflies from your own observation, you should keep them where you can watch them from time to time. To do this it would be well to rear caterpillars in confinement. Here is a very simple method for making a cage in which to do this. Take a common glass lantern globe, and over the top stretch a piece of thin cloth, such as mosquito netting, which can be held in place by a rubber band. Partly fill a saucer with sand or earth and in the middle place a bottle filled with water, into which you have thrust a sprig of the plant on which this particular caterpillar feeds. Be sure that the bottle is not so high that the caterpillar could not crawl upon the leaf again if it should fall off. The caterpillar may now be put upon one of the leaves and the globe placed over the saucer. Fresh leaves must occasionally be put into the bottle and the caterpillar transferred to them.

A box with a glass top may be used instead of the globe, but the cage that has been described is readily cleaned, and admits plenty of fresh air, while at the same time the caterpillar in it can be closely watched.

Pictures of the various kinds of Butterflies, showing all of their colors, can be made very easily by a method known as "printing," which will now be described. With your scissors, clip off the wings of a dead Butterfly quite close to the body, and keep the body for future use. Now take a piece of white paper and, after folding it in the middle, cover the inner side with a solution of gum arabic. Press the two sides together and pass your hand over them gently, so as to distribute the gum evenly. Separate the two parts of the paper and put the Butterfly's wings in place on one of them, leaving space between the wings in which to print the body. When you have the wings placed properly, fold together the two parts of the sheet of paper, then place it under a heavy weight or in a press to dry. When dry, put the folded paper against a window pane, so that by looking through it toward the light, the wings can be clearly seen. Now draw a line around the edges of the wings with a soft, black pencil, and moisten with water the part outside the line. Here you must be very careful to see that no water runs into the part inside the line you have drawn, for if it does so the print may be spoiled. In a few minutes the gum will soften, and the two sides of the sheet may be easily separated. On one part of the paper you will have a perfect picture of the upper side of the wings, and on the other part



a picture of the under side will be found. Now, with pen and brush, sketch the body between the wings, coloring it like the natural body which you have kept for a model. The result will be a beautiful picture that preserves the colors and form of the natural Butterfly.

## MOTHS AND SILKWORMS

WHEN you hear the word "Moth," no doubt you are reminded of the little creature that causes so much annoyance to the housekeeper by getting into carpets, woolens or furs, to which he is most destructive. This is only one kind of Moth, however, and there are many other varieties, some of which are larger than our largest butterflies, while others are so small that they can scarcely be seen, except through a magnifying glass.

Before being told about some of the more common of these, it will be well for you to learn some of the ways in which they may be distinguished from butterflies. The butterflies are seen in the daytime, and when they are resting, either on a plant or on the ground, they hold their wings erect; the little feelers that grow out of their heads are very slender, and at the end of each of them is a small knob. Now the Moths, with a few exceptions, fly after darkness has begun to fall; when they are at rest their wings are flat; and the little feelers that grow from their heads have no knobs at the ends. You may also have seen the silken cocoons made by the caterpillars of the Moth, unlike those made by the caterpillars of the butterfly.

### THE FIVE-SPOTTED SPHINX, OR HAWK MOTH

One of the most attractive of the Moths is the Five-spotted Sphinx, or Hawk Moth, that flies about the gardens at dusk and sips the nectar from the sweet blossoms, by means of its long tongue. It darts swiftly here and there and the fluttering of its wings makes a noise among the flowers, like that made by a humming-bird. On this account, it is sometimes called the Humming-bird Moth. This Moth hovers like a hawk over the spot on which it is about to alight, and because of this habit it has been called the Hawk Moth.

The name, Five-spotted Moth, comes from the five orange-colored spots on each side of its body, which you have probably noticed. The color of its wings is gray, marked with black.

In order to understand the life history of the Moth, we must trace it through much the same stages as we did that of the butterfly. The caterpillar of this Moth may often be seen on tomato vines, and it is

commonly spoken of as the tomato worm. It is from this crawling object that the beautiful Moth develops.

The caterpillar is of a light-green color, and has white stripes on its sides. Its tail ends in a sort of thorn. When it attains its full size, usually in the month of August, it is about three inches in length. When its growth is complete, it crawls down the stem of the plant on which it has been feeding, and buries itself in the ground. It then packs the earth about itself in such a way as to form a cell, and after a short time it throws off its caterpillar skin and becomes a chrysalis of a bright brown color. If you were to examine this chrysalis, you would observe a structure at one end that looks like a jug handle. This is the case that contains the long tongue of the Moth. The chrysalis remains in the ground all winter, but when summer comes it hatches and the large Moth leaves the shell and crawls to the surface. If it makes its first appearance in the daytime, it conceals itself under leaves, or in some other quiet spot, until evening, when it flies away, in search of the flowers that furnish it with food.

#### THE CLEAR-WINGED SESIA

If you have ever noticed a Moth with transparent wings and a broad, fan-shaped tail, flying about in the brightest sunshine, instead of in the evening, you doubtless observed something about him that made him quite different from the other Moths. When he wishes to sip the honey from a flower, he does not alight upon the blossom as the others do, but poises himself above it and supports himself in the air by keeping his wings in rapid motion. This Moth is called the Clear-winged Sesia.

#### THE BEAUTIFUL DEIOPEIA

The prettiest of the Moths does not make its appearance until toward the end of summer. Its fore wings are yellow and each has six white stripes, which are marked with little black dots. The hind wings are bright scarlet in color, and have a wide, irregular border of black. The name of this little Moth, which is usually seen in the fields, is the Beautiful Deiopeia. When in the caterpillar stage, it feeds upon the leaves of the blue lupine and the wild forget-me-not.

#### THE SILKWORM

The most interesting member of the Moth family is the one that develops from the Silkworm, for it is from the cocoon made by the caterpillar of this Moth that we get the greater part of our silk.



This cocoon is the covering that the caterpillar spins for itself, before entering into the chrysalis state. The egg from which the silkworm is hatched is no larger than a mustard seed, and when the little creature is first seen, it is only about one-tenth of an inch in length. Like the other caterpillars, it has a voracious appetite and grows rapidly. It is also, like other caterpillars, in the habit of shedding its skin several times before reaching full size. You will find this little creature feeding on the leaves of the mulberry-tree, and you may be surprised to know that it eats many thousand times its own weight during its caterpillar life. Its color is pale green, marked with darker spots, and its head is black.

On account of the value of the silk taken from the cocoons of these little creatures, they are bred and tended with great care. When the Silkworm is seen to be ready to make its cocoon, it has placed near it a twig, or a roll of paper, or some other hollow article into which it can crawl, and to which it can attach its silken threads. First, it spins a loose covering of silk; then, inside of this, a second covering of finer silk, the threads of which it glues together with gum; and inside of this, a lining of still finer silk, which is even more firmly glued together. In the cocoon formed in this way, the little chrysalis will be well protected from the rain, wind, and cold. The cocoon is about an inch, or an inch and a half, in length and is of a yellow color. Soon after it is finished, the caterpillar changes to a chrysalis, in which state it remains from two to eight weeks, according to the climate. The color of the Moth which comes forth from this chrysalis, is a grayish or yellowish white.

The value of the Silkworm has long been appreciated. It has been known in China for about four thousand years, and from that country has been carried to many other parts of the world. In France, Spain, and Italy, many thousands of people find employment in feeding and caring for Silkworms and in winding the silk from the cocoons.

#### THE AMERICAN SILKWORM

The Silkworm that has just been described is not commonly found in our country. We have several varieties of caterpillar, however, that form silky cocoons, but so far as is known, only one that forms cocoons from which the silken threads may be unwound. This caterpillar is a beautiful light green in color, and has pale yellow lines on its sides; on each of the ring-like parts of its body is a little wart, tinged with orange, red, or purple. It is hatched from the egg in June, and in summer it is frequently seen on the leaves of the oak tree, of which it is very fond. It is difficult to believe that by

the time it is full-grown it has eaten at least one hundred and twenty leaves. During its period of growth, it sheds its skin five times, and about the latter part of September, when it is fully grown, it is ready to make its cocoon. Before beginning to form the cocoon, it spins silken threads, from one leaf to another, until it has drawn three or four leaves around itself, in such a way that they inclose and partly conceal the cocoon. Inside of these leaves, it spins in all directions until it is completely surrounded by silken threads, within which it spins other layers of silk, which it glues together with a gummy substance. You may wonder how it is that the finished cocoon is only about half as large as the caterpillar when it begins to spin; but this is readily explained by the fact that the creature becomes smaller by spinning because the silk is made from a fluid which flows from its body. The cocoon is completed in four or five days, after which the caterpillar is changed into a chrysalis, and remains in that state all winter, sometimes frozen hard. The next summer, generally in June, the large, handsome Moth comes forth. This Moth lays its eggs, three hundred or more, on the under side of the oak leaves, and the eggs hatch in ten or twelve days.

#### THE LUNA MOTH

Another of the large moths is the Luna Moth, which is sometimes called "The Pale Empress of the Night." Its wings stretch out four or five inches from tip to tip, and extend backward into a long tail. It is an attractive insect, having wings of a delicate light-green color, on each of which is a clear eye-like spot bordered with white, red, yellow, and black.

This Moth deposits its eggs early in the summer, on the leaves of trees—usually selecting the walnut tree. The caterpillar, which, when full grown is two or three inches long, is of a bluish green, with a yellow stripe on each side of the body, and yellow bands on the back. Late in summer, it draws together two or three leaves and spins its cocoon inside of them. The cocoon falls to the ground with the leaves, in autumn, and remains there until the warmth of the following spring calls the Moth to life, and it comes forth, a marvel of insect beauty.

#### THE CECROPIA

The Cecropia Moth has wings that measure fully six inches between the tips. They are of a dusky brown color, with clay-colored margins; and on each is a large reddish spot with a white center. The caterpillar of this Moth, which may be found in groves or near



the borders of woods, is about three inches long. It is of a light green color, and its body is spotted with red and yellow warts, armed with short bristles.

#### THE PROMOTHEA

The Promothea Moth has brown wings, with a drab border, which are prettily marked with wave-like lines of red and white. The caterpillar lives on the leaves of the sassafras tree. It is pale green, with yellow feet, head, and tail, and on its body are red, yellow, and blue, warts. The way in which it prepares itself for the chrysalis state is very interesting. Before making the cocoon, in which it is to stay all winter, the caterpillar spins many silken strands from a leaf to the twig on which it grows, thus preventing it from falling to the ground with the other leaves in autumn. It then spins its cocoon on the leaf, after bending over the edges, so as to form a complete covering. This protection enables it to brave all the storms and blasts of winter.

#### THE LEAF-ROLLER

There is a pretty little Moth called the Leaf-roller. He is very small, and has fore wings that are prettily striped and banded, and sometimes ornamented with little spots which shine like polished silver and gold. He gets his name from a peculiar habit that he has while in the caterpillar state. He rolls up the edges of a leaf and fastens them together with threads of silk, so as to make a little case in which he lives and upon which he feeds. Other little caterpillars live in leaf and flower buds, closing them up with threads of silk, and then feeding upon the tender leaves.

### BEETLES

**B**EETLES belong to the class known as Coleoptera of which over ten thousand distinct shapes are known in North America alone.

They are distinguished from other forms by the two hard wings which inclose and protect the two thin membranous wings. The first pair are used only for protection, and the second pair only for flight. The jaws of these animals are very strong in proportion to their size, and are used for gnawing the vegetable or animal matter upon which they live. Some live upon decaying matter and in this way are very beneficial; others, again, live upon trees and are very destructive. The eggs of many of the beetles are deposited in the wood

of trees and under the bark, and the insects pass through the form of the Larva and the Pupa into the adult beetle form. The Potato-bug or Potato-beetle lived until 1855 in the Rocky Mountain Region. As the potato came to be planted near the Rocky Mountains the insect increased rapidly and strayed towards the East. It was found on the Atlantic coast in 1874, and has since proven a pest to the farmers. The young and the beetle both feed upon the leaves of the potato. The Pupa or worm-growth is formed at the foot of the plant in the earth. There are three generations each year, and the full-grown adults of the last generation live over through the winter. The most effective insecticide in this case is Paris Green.

The Lady-bug, or Lady-bird, or Lady-beetle, is named from its form and bright coloring. Its young live upon small insects, and one variety eats the leaves of plants. In general the species is harmless, and is represented by a great many varieties in the United States.

Fireflies or Lightning-bugs have the power of shedding light by a phosphorescent glow from the abdominal part of the body. The young of these beetles live in the ground and feed upon earthworms. The Pupa develops in a cell in the ground in June and after ten days emerges as a full-grown beetle. Some larger species in South America emit so strong a light that small print may be read by means of it.

Water-beetles and Whirligig-beetles may often be seen floating upon the surface of water and moving rapidly about with a circular motion.

## HOUSE-FLY

THE cheery little House-fly that flies from room to room, now in and now out of the window, now crawling upon the ceiling, now sipping at any sweets that may be placed at his disposal, is a very interesting little insect.

Perhaps you have already observed that the body of the fly is divided into three parts, the head, the thorax, and the abdomen, and that he has only one pair of wings, which are transparent and gauzy. Like all true insects, the Fly has six legs.

Have you ever tried to catch a Fly? If you have, you know how difficult it is to prevent his seeing every movement made toward him from any direction. This power of the Fly to see on all sides at once, is due to the peculiar construction of his eyes. If you could examine them under a magnifying glass, you would observe that they are made up of a great number of six-sided little faces, which are turned in different directions. From each of these little faces the Fly is able



to see as well as from a separate eye. Thus you can understand how easy it is for him to watch in all directions at once. These compound eyes are characteristic of all insects. Another peculiarity about the eye of the Fly is that it is not protected by any lid or covering.

The Fly is so constructed that he cannot eat, but can only drink. Consequently, he lives on liquid food, which he takes through a little sucker or trunk. This may seem strange, for no doubt you have seen him feeding on dry matter, for instance, dry sugar. This is explained by the fact that the Fly exudes a substance which moistens the dry food and converts a part of it into a liquid.

You have probably wondered why the Fly is able to run up and down the window pane so easily, and upon the ceiling with his back downward. His feet are covered with hairs, each of which ends in a little disk, which is supposed to act as a sucker and to exude a liquid, which makes his adhesion to a surface perfect.

The female Fly lays her eggs in bunches or clusters in almost any kind of decaying animal or vegetable matter, or in any kind of filth. These eggs hatch in a day or less, if they are kept sufficiently warm. When first hatched, they are small, white, headless, worm-like objects, called maggots. These maggots feed upon the substances on which they find themselves when hatched, and in about two weeks they attain their full size. They then develop into the *pupa* state, in which their color is brown. In this condition they remain a week or two, and at the end of that time the perfect Fly emerges.

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THERE are quite a large number of the two-winged insects quite intimately related to the House-fly. It is fortunate that these are not so common, for, troublesome as the House-fly is, most of the insects belonging to his family are more annoying and some are quite destructive.

There are two species which, in the grub or larval state, cause the farmer much annoyance and considerable loss by feeding upon the sap of growing wheat. Some of you may have heard of the Wheat-fly and the Hessian-fly. They are very small in size, the Hessian-fly being less than a quarter of an inch in length, while the Wheat-fly is even smaller.

With the exception of a few minor details, the life history of these flies is the same as that of the House-fly; in fact, most flies pass through the various stages of development in much the same way.

The female Hessian-fly lays her eggs on the blades of wheat, and the grubs hatch out in four or five days. Almost immediately after

hatching, these grubs crawl down the plant and attach themselves to the stem, just below the surface of the ground. They remain here, feeding upon the juices of the plant, until they reach their full growth and pass into the *pupa* state, from which they will emerge as perfect insects. The grubs of these Hessian-flies not only retard the growth of the tender wheat by feeding on the juice, but very frequently they kill it completely.

The Wheat-fly differs from the Hessian-fly in the placing of her eggs. She lays them, not upon the blades, but upon the blossoms of wheat and other grains. The grubs that hatch out nourish themselves by feeding upon the blossoms and tender growing kernels.

You all are sufficiently familiar with the mosquito to know that his bite is by no means pleasant, and you are not anxious to have him visit you; but the inhabitants of the northern part of the country have to contend with a fly that is even more troublesome than the mosquito. This is the Black-fly, which is found in the northern part of the United States and in Canada. This fly is found in large swarms during the early summer, especially in the month of June, and hunters and fishermen suffer greatly from his bite, which draws blood and causes great irritation and pain. The body of the Black-fly is black, as his name indicates, and his wings are transparent.

Those of you who have been much around horses, especially in the country, have, no doubt, seen an insect flying about them which resembles an ordinary house-fly, except that it is much larger. This insect is the Horse-fly. He is very annoying to the horses, for he pierces their skins with his sharp lancet-like jaws and sucks their blood. He is very persistent in this work, and it often requires much effort on the part of the driver to succeed in chasing the pest from his horse. The Horse-fly is remarkable for the size of his eyes, which form the greater part of the head and are very beautiful.

The Bot-fly is notable chiefly for his dwelling place while in the grub, or larval state. He infests the different parts of animals; for instance, the Horse-bot lives in the stomach of a horse, and the Ox-bot which makes his home under the cuticle of the ox. In the insect state, the Bot-fly is about the size of a Bee.



## MOSQUITOES

WHETHER the mosquito was present with Noah in the ark is uncertain, but history tells that it was known in ancient Greece and in Asia and that the inhabitants of some cities were forced to leave their homes to escape from it; and the story reads that during the siege of Nisibis, mosquitoes caused a rout of the army of Sapor, king of Persia, by attacking his elephants and beasts of burden. The soldiers in the Crimean War suffered so much from them that they were forced to sleep in sacks, but even this did not afford sufficient protection, and some of the soldiers died from the stings of the voracious little insects.

At this time, the mosquito claims every country for its own. Some localities in South America, India, and Africa swarm with these insects, and in Alaska they are said to be more numerous and ferocious than in temperate climates.

Much valuable and authentic information concerning the mosquito has lately been collected by the many eminent medical and scientific men in this and other countries who have given a vast amount of time and experimental study to the subject, and the results of their investigations have been made so available through the reports published in scientific journals and the general press, that we may now study the insect, following it from the first stage of its life, through each step in its development.

Mosquitoes breed in water. The most common species is that known as *Culex pungens*, which deposits its eggs on the surface of the water, in batches of from two hundred to four hundred, infinitesimal in size. These egg masses remain floating on the water about sixteen hours, if the weather is warm; during a cold spell in the summer, they have been known to remain several days. In hatching, the *larvæ* emerge from the under side of the mass and drop into the water. Even at this stage, they are exceedingly active and wriggle about in the water very rapidly, but they are so minute that only by very close watching can one form any idea of their shape and construction.

While in the *larva* state they remain under the water, coming to the surface every few minutes to breathe, taking in the air through a breathing tube which protrudes near the end of the abdomen. The *larva* must, therefore, breathe with its head under the water, and during the process of breathing, the mouth may be seen constantly vibrating and devouring any particles of food that come within reach.

The next stage is reached in not less than seven days. During this time the *larva* passes through three periods of growth and be-

comes a *pupa*. It is now lighter than in the *larva* state, and has trumpet-shaped breathing organs issuing from the thorax. It remains in this stage only two days, if the weather continues warm, when the skin splits down the back, allowing the head and body to be drawn out, but it still rests on the skin, and floats about on the water for a day or two as though in a boat; at the end of this time, its wings are firm and dry, and behold! a full-fledged mosquito, well equipped for the business of life, a period of ten days having elapsed since the eggs were laid. This is given as the minimum time required for hatching in a temperate climate. It now begins to forage for food. The mosquito's natural food seems to be the proteids of plants; ripe fruits, such as bananas and watermelons are favorite articles of diet; and mosquitoes have been seen to feed on cooked food, inserting their beaks into boiled potatoes.

The male is strictly vegetarian in diet; he has not been known to taste blood, but it also seems that he alone is prone to the liquor habit, having been known to drink beer, wine and even whisky, which the female does not touch; but alas! it is she who does the biting, and consequently carries disease.

Since mosquitoes breed in great numbers in swamps and marshes that are never visited by animals, it will be seen that very few ever taste blood; but they have been known to attack other insects, and they also suck the blood of birds. Pet canaries have suffered almost unto death from their bites.

Mosquitoes are said to have the faculty of hearing more acutely developed than any other insect. It has been found that some of the hairs on the antennæ respond to certain vibrations of sound, while others are so tuned that they respond to other notes; by this arrangement the male is enabled, by turning his head so that both antennæ are in a position to catch the vibrations of the song of the female, to guide himself unerringly to her exact locality.

We all know there is a great variety in the tones of the mosquito's voice; some have supposed the voice of the female to be invariably pitched higher than that of the male, but close observers assert that the voice of the female of the genus *Anopheles*, known as a malaria bearer, is pitched considerably lower than that of the comparatively harmless genus *Culex*. It is said that an intimate acquaintance enables one to distinguish the different species by the tones of voice.

The length of an adult mosquito's life is difficult to determine, since in captivity the artificial conditions render it variable. It is quite certain, however, that mosquitoes pass through several generations in one season (in warm climates ten or twelve), and since the descendants of one female are estimated in a single season to num-



ber well into the millions, it is easy to see that the supply is likely to far exceed the demand.

Mosquitoes are good travelers and fond of traveling by both boat and rail; and there are well-verified instances of their having been carried long distances in this way to localities having no known breeding-places, and where mosquitoes had been unknown before the advent of the railroad. A number of years ago it was told as a probable fact, that no mosquitoes were known in Cincinnati, Ohio, until, during the Civil War, they were brought there from the South on the river boats. It is said there were none in Hawaii until they migrated in sailing vessels from the United States; but the numerous swamps and fresh-water ponds furnish abundant breeding-places, and they improved their opportunities so well that they are now very plentiful there.

Every species of mosquito does not carry disease; the genus *Culex pungens* is a harmless though annoying little fellow, and is the most common of those in the United States; but in the genus *Anopheles*, medical men everywhere are recognizing a most prolific cause of the spread of malarial diseases. The army medical experts of this and other countries are directing their experimental work to the extermination of the mosquito, in the belief that by this means a very large proportion of sickness in malarial districts may be prevented, and they have proven that when the insect has been excluded from the houses and proper care taken to prevent further inoculation, patients suffering from malaria have promptly recovered and no new cases have been developed.

Dr. L. O. Howard of the Department of Agriculture, in Washington, in a recently-published, able and comprehensive work on "Mosquitoes: How they Live, How they Carry Disease," etc., states that "so far as we know at the present time we have but three species of the malarial genus in the United States, namely, *Anopheles maculipennis*, *Anopheles punctipennis* and *Anopheles crucians*." The first two are found everywhere in this country, as well as in many others. *Anopheles punctipennis* is more treacherous than *Culex pungens*. It never stops to deliberate or give warning of its coming, but plunges at once at its victim and loses no time in drawing the blood and getting away with it. It will bite while a person is asleep without awaking him, and thus his presence is often unsuspected.

To transmit disease, it is not necessary that the mosquito should be present in large numbers, nor does the presence of the disease-carrying *Anopheles* presuppose the existence of disease. There must first be a well-developed case of malaria with which the mosquito may come in contact, and a single one, if inoculated with the poison,

is sufficient to convey it to others. Several days are required for the disease to mature in the system of the mosquito—in yellow fever at least twelve days—before it can be transmitted to a new victim.

The *Anopheles* breeds in stagnant water and likes foul places; it is frequently found in great numbers in crowded tenement houses. It hibernates during the cold weather in warm cellars and barns in the South, and cases of disease have been distinctly traced to its bite.

During the late war in Cuba, Dr. Sternberg, Surgeon-general of the United States army, who had previously given the subject much careful study, with an able corps of assistants, made numerous experiments in the hope of finding the real nature of infection in malaria and yellow fever. Dr. Sternberg established a commission, composed of army surgeons, for the express purpose of investigating yellow fever from the mosquito standpoint. From the results of their experiments, as reported by Dr. Walter C. Reid, under whose direction they were carried on, many important facts were gathered concerning the spread of these diseases.

One of the deductions of the commission was that the mosquito heretofore known as *Culex fasciatus* is largely responsible for the spread of yellow fever, and that it is not conveyed, as popularly supposed, by infected clothing. This theory is borne out by the fact that non-immunes, in rooms from which mosquitoes had been excluded, actually slept in the soiled garments and bedclothing of those who had died with the fever and remained in perfect health, while of those in rooms from which all infected clothing was carefully excluded and every means of disinfection used, but contaminated mosquitoes from fever patients were admitted, six out of every seven bitten by the infected mosquitoes took the fever. The period of incubation in the human system varies from forty-one hours to five or six days.

Having proven, beyond a doubt, that yellow fever is certainly transmitted to individuals by the bite of the mosquito that has fed on the blood of those sick with the disease, the only natural sequence is that the sure way to prevent the spread of it is to destroy the mosquito. That complete extermination can only be accomplished by systematic and persistent effort is obvious, when one considers the enormous rapidity with which they multiply, but experiments have shown that very much may be done, even in one season, to reduce their numbers.

It has long been supposed that mosquitoes were carried long distances by the wind, but recent observations lead to the conclusion that this is the case only with certain species and under exceptional



conditions, for most mosquitoes are incapable of flying more than a few hundred yards. This point has an important bearing on the question of exterminating them, since the inference is that when supposed to have come from a distance, a close inspection of near-by breeding-places would result in a change of opinion and in an attempt at ameliorating the conditions.

A very small amount of water is sufficient for the production of an enormous number of mosquitoes, more than thirty-six thousand eggs, *larvæ*, and *pupæ* having been taken out of an ordinary rain-water barrel within sixteen days. To destroy these is the first step, and for this purpose nothing has been found more effectual than petroleum or kerosene, poured upon the surface of the pool or other breeding-place. The oil spreads readily over the water, shutting off the air supply from the *larvæ*, and, as they come to the surface every few minutes to breathe, the work of destruction is very quickly done. The treatment must be repeated at an interval of every twelve or fifteen days, and no possible place that could harbor them must be overlooked. Mosquitoes are often found clinging to the underside of the covers of cisterns and water tanks; these should be made perfectly tight and the contents treated with kerosene.

All surface pools should be promptly filled with earth, and low, marshy lands and swamps should be top-drained. In the case of clear streams and pools, where draining is not advisable or possible, small fish, the natural enemies of mosquito *larvæ*, may be introduced. These feed on the *larvæ* and *pupæ*. The little stickleback has been found to be one of the best fish for this purpose; so, also, has the top-minnow, which is so small that it can dart in and about the small places between the leaves of plants and in shallows. The common sunfish is recommended by Mr. W. P. Seal of New Jersey, who has experimented with it, and although larger than either the stickleback or minnow, it is very prolific and grows so slowly that it remains quite small the first year, and it is very voracious and wholly carnivorous.

In some districts in Cuba, the use of petroleum on water where the mosquitoes breed, with the use of mosquito bars to prevent further inoculation, has so effectually destroyed the *larvæ* that the prevalence of malaria has been considerably decreased. All this has to do with the destruction of the insect before its development. The adult mosquito is also affected by the fumes of kerosene, and some will meet death as they go to the petrolized water to deposit eggs. In houses, when resting on the ceiling, they may be captured one by one by the use of a small, shallow tin-cup—a can cover will do—nailed to the end of a long stick.

Into this cup put a small amount of kerosene and push it up under the mosquito, which will fall into the cup and be smothered. A little practice will enable one to catch them very rapidly. Doors and windows should be closely screened, however, or they will enter faster than they can be disposed of. They will hide under curtains or draperies, waiting for an opportunity to make themselves heard and felt, and these should be shaken to bring them out upon wall or ceiling.

The smoke of pyrethrum powder will stupefy and sometimes kill them. A remedy given by Dr. C. Fermi, the Italian investigator, is to put into a dinner plate four or five spoonfuls of chloride of lime; into this pour from five to ten centimetres of crude sulphuric acid. The chlorine gas thus liberated kills the mosquitoes. As a remedy for the smarting of the bites, pure glycerin is said to be one of the best of the many things suggested, relieving the pain and preventing any swelling.

Some of the distinguishing characteristics of the species of mosquitoes common in North America will help to determine to which class they belong:—

To the genus *Culex* belong nearly all the most common and most widely distributed mosquitoes; *culex* means midge or gnat. The species heretofore known as *Culex fasciatus*, with which the yellow-fever experiments referred to were made, is now placed by Dr. Howard and European scientists in a different class, and is to be known as a *Stegomyia*.

The genus *Uranotocenia* is rarely found; it is one of the smallest, and is known by a stripe of violet-blue scales around the thorax. *Aedes* is also rare and small; it is brownish in color with golden-yellow scales on thorax and a cross-band of white on the abdomen.

There are two species of *Conchyliastes*, rather rare, one with the last two joints of the hind feet white, one with only the last joint white.

Of the *Stegomyia* there are two species. *Stegomyia fasciata*, the only known yellow-fever carrier, is very handsome, with banded legs and silver stripes on thorax and body. It breeds almost anywhere in standing water, and is known in many warm countries. It bites worse in autumn than in summer.

The genus *Psorophora* is of a yellowish color varied with brown; it is considerably larger than any other of the yellowish or brown mosquitoes. Among the largest is also the *Toxorhynchites*; this has feet marked with white. *Megarhinus* gives us three species, rather large, distinguished by white and yellow marks on the feet. These have not been found north of the District of Columbia.

Genus *Anopheles* was described in 1818 by Meiger, who refers to it as "a new fish," he has found, which he calls "an aquatic caterpillar." Dutch, English and Italian investigators have also studied and described this species. Only three species are known to exist in the United States:—

*Anopheles maculipennis* is a rather insignificant creature; its wings marked with four small, dark spots, the *palpi* being black.

*Anopheles punctipennis* is our very handsomest mosquito; a yellowish-white spot extends about three-fourths the length of the front margin of the wing, and the scales at each end are black. The hind feet are wholly brown.

*Anopheles crucians* has three black spots on the wing.

The *larvæ* of the *Anopheles* have been found in large numbers in the winter, frozen into the pitcher plant, the cup of the plant afford-



ing a sufficient breeding-place, and when thawed out the *larvæ* developed and the mosquitoes were kept alive for some weeks, or even two or three months. The adults also of this species, as well as of most of the others, hibernate during the winter, and a "warm spell" may bring them from their hiding-places ready to renew their attacks.

## BUGS

THE Bugs belong to a class known as the Hemiptera, some of which live both on water and on land. The Chinch-bug is the most destructive of this group, as it lives upon wheat, maize and other vegetable products, especially in the South and West of the United States. The Squash-bug belongs to the same family and is especially destructive to young squash and pumpkin plants in the early spring. The lice which infest both animals and plants live upon the blood and juices of animals and plants and are often destructive. One of the worst pests of this group is the Phylloxera, or plant louse, which destroys millions of dollars' worth of plants in the vineyards of the world. The scale insects are to be found on nearly all fruit trees and plants. Their bodies have a downy or waxy covering in which they remain for the purpose of laying their eggs.

## DRAGON-FLY

PERHAPS the name Dragon-fly does not recall to you the insect that is about to be described, but when you are told that it is none other than the "Devil's Darning Needle" or "Snake Doctor," you will probably remember him at once as an insect that you have often seen.

We may class the Dragon-fly among the useful insects, for he carries on an unceasing warfare against the troublesome and annoying mosquito; but he has beauty as well as usefulness to make him an interesting subject for study. Notice his large, lustrous eyes, each of which is said to be furnished with as many as twelve thousand compound lenses, by the aid of which he is enabled to see objects on all sides at one time. His body is resplendent with gold, green, and black, but his chief beauty lies in his beautiful gauzy wings, the structure of which is more delicate than the finest lace.

You may have been told that the Dragon-fly has a poisonous sting, or that he can use his slender body as a needle and sew your skin. Such statements are entirely false. The Dragon-fly has no sting and

is incapable of injuring you in any way; so when he comes near, you need have no fear of him.

You do not find the Dragon-fly flying about at night, but if you discover him then, he will be seen clinging to the under side of a leaf or twig for shelter, and in the morning he does not go forth to hunt his prey until the dew is off the grass and the sun has put new life into his veins.

The Dragon-flies are short-lived in the form of the perfect insect, the limit of life probably not exceeding three weeks or a month, and as they are not skillful in finding shelter from rain, large numbers of them are frequently killed by it.

You have probably noticed that Dragon-flies are most numerous over lakes and ponds, and you may have seen some of them curve their bodies and thrust them into the water at intervals. The Dragon-flies that dip down into the water are females engaged in laying their eggs. At each movement one of them deposits from twenty-five to forty bright apple-green eggs. These eggs sink, and adhere to water plants, sticks, stones, or other objects, beneath the surface of the water. The eggs laid in early summer hatch in about a week; those deposited late in the autumn usually remain unhatched during the winter months.

The egg hatches into a little, active, six-legged worm. By and by, the little worm develops two small "wing pads" or rudimentary wings, that forecast his future life in air; but until the *larva* is transformed, he moves about in his native water, preying upon his fellow-creatures, such as the *larvæ* of caddis-flies, or mosquitoes.

When the *larva* is fully grown he develops into a *pupa*, his body changing from its worm-like form to one having an appearance more like that of a perfect insect.

When the *pupa* comes to the last stage of his water life, he crawls out of the stream and emerges from his skin. His little wing-pads gradually but rapidly expand into the beautiful wings of the Dragon-fly, and away the brilliantly painted insect flies, to begin at once a remorseless warfare upon mosquitoes, grasshoppers, flies, and other soft-bodied insects.

The entire life of the Dragon-fly, from the time the egg is laid until he dies, after passing through his various stages of life as *larva*, *pupa*, and the perfect insect, is from nine months to a year.



## MAY-FLY

THIS pretty little relative of the dragon-fly lives only a few hours, or at most, only a day, after he gets his wings. He is seldom seen except in swarms, in which the May-flies are so numerous that the air is filled with them, as it is sometimes with snowflakes in winter.

The head of the May-fly is small and rounded. His large eyes meet on top of his head, and he has small antennæ or feelers. Strange as it may seem, the May-fly has no mouth, or, if he has one, it is very rudimentary. Perhaps the reason for this is, that in his winged state he takes no food and does not need a mouth. His body is very slender, ending in two long and very delicate filaments or tails. The wings of the May-fly are somewhat like those of the dragon-fly, being very thin and delicately veined. The hinder wings are much smaller than the front wings, or are wanting altogether.

The May-fly lays her eggs in the water, in little balls or clusters, each cluster containing several hundred eggs. These clusters sink to the bottom of the river or pond, the eggs separating and soon hatching into small *larvæ*.

The *larva* of the May-fly lives in the water, under stones or in holes, which he digs in the banks of ponds or streams. These holes or burrows are made below the surface of the water, in soft soil, or if made in the coarse soil, they are lined with fine earth. They have two openings, so that the little creature can go in and come out again, without having to back out, or turn around in his dwelling.

Though so fragile and short-lived in his winged form, the insect in his larval and pupal states is long-lived, sometimes existing for as many as two or three years. The *larva* has well-developed jaws, and preys upon other water-insects for his food. He is notable for the number of times he molts or casts his skin, which he sometimes does as often as twenty times.

When he is ready to change into the winged form, he swims to the top of the water and bursts out of his pupal skin so quickly that he seems almost to fly out of the water. If you should see him at this time, you would believe him to be a perfect May-fly, but he is really still covered with a very thin and delicate skin, so he flies to the shore and alights upon a plant or tree. Here he casts off the final skin, after which you will notice that his wings are much brighter and his tails are longer. The little insect then flies off to enjoy his short existence, an existence lasting at most only a few hours.

The Orthoptera include Grasshoppers, Crickets, Katydid, Locusts, Cockroaches, etc.

## KATYDID

THE Katydid is so called from its peculiar notes, which seem to be like the words "Katy did." He belongs to the same family as the locusts and, of course, resembles them in most particulars. You may find him on the trees, but as his color is green, it is quite difficult to distinguish him from the leaves. He is a pretty little creature, with his very long, delicate feelers, and his beautiful leaf-like wings.

You will, no doubt, like to know how he makes the sounds which you have heard so often. Suppose you catch a Katydid and carefully examine him. You will notice in the upper part of each wing cover, near where it is joined to the body, and where one wing cover laps over the other, a little membrane, which looks somewhat like thin glass. This membrane is set in a sort of frame, and when the Katydid opens and shuts his wing covers, these frames are rubbed against each other. This rubbing produces the sounds from which the Katydid derives his name.

The female Katydid forces the hind part of her long body into crevices in the soft bark and stems of plants, and there she lays eggs from which young insects hatch in the spring. The life of the Katydid is similar in its details to that of the locust, about which you have already heard.

## CICADAS

ON WARM days in July and August, you may have noticed a peculiar, shrill noise issuing from among the branches of the trees, and you may have tried to discover the insect that causes it, but he usually keeps so close to the limbs and leaves, and so high, that you can seldom see him. This shrill-voiced insect is the Cicada, but he is commonly, but incorrectly, called the locust.

The body of the Cicada is quite heavy, his head is blunt, and he has very prominent eyes. The upper part of his body is black, striped with green; the under side is covered with a white substance, which has the appearance of flour. His wings are large and are composed of a thin, gauzy substance. The noise that you hear is made by the males alone, the females have no share in the energetic chorus. To make this noise, the male Cicada is provided with a special apparatus, resembling little kettle-shaped drums; the wings vibrating against these cause the shrill noise.



The female lays her pearly eggs in holes, which she makes in the branches of trees, one Cicada often laying several hundred. A few weeks later, these eggs hatch into the *larvæ* or grubs which, almost as soon as hatched, crawl to the side of the limb, let go their hold and fall to the ground. They then bury themselves in the soil, and make their way to the roots of a tree, which they pierce with their sharp beaks, in order to feed upon the juices.

When a *larva* has reached maturity, he comes out of the ground at night, crawls up the trunk of a tree, or upon a fence, and clings firmly with the little claws of his feet. His skin soon becomes dry, and splits down the back; the Cicada then comes out, leaving the empty skin still fastened to the tree or fence.

Some broods of adult Cicadas are seen only at long intervals. The seventeen-year Cicada is seen only once in seventeen years. The *larvæ* of this insect remains in the ground during this long period. The fully developed insect has a wing-expanse of about three inches. The veins of its wings, as well as its legs and the rings around its body, are of an orange-red color.

## LOCUSTS

THE familiar song of the Locust, which you have so often noticed in your rambles through the fields and meadows, is the song of the pest whose ravages have so often desolated whole countries and left the fields perfectly bare. Fortunately, it is only in certain regions that Locusts are found in numbers sufficient to do any considerable damage. The western part of our country is the only portion of it that has often been overrun by these insects.

Most varieties of the Locust lay their eggs in holes, which the females have dug in the ground, by means of the hooks or claws at the end of their bodies. These holes extend about two inches below the surface. The young hatch in the spring. At first they have no wings, but crawl about, eating grass and growing very fast. In the crawling stage, which lasts from forty-five to fifty days, the little insects shed their skin several times, developing at last into perfect Locusts, with thin, delicate and often beautifully colored wings. They have very large, strong, hind legs, which give them great power in leaping. Their jaws are strong, sharp and jagged. When at rest, their wings are disposed in straight folds. They fly very well, but are often conveyed by the winds to greater distances than they would be able to go unaided.

The song of the Locust, as you well remember, is not a particularly elaborate one. He merely raises his hind legs and with them scratches his wings a few times with regular strokes, the number of strokes varying from seven to sixteen. In bright, sunny weather the little songsters are merriest, and then they scrape rapidly the little violins provided by nature.

Probably, you would like to hear how the Sprinkled Locust builds her nest. If you should see one in the act, you might be tempted to believe that it was a Locust growing out of a stick. This insect makes its nest in half-decayed wood. To do this, the female is compelled to bore deep holes in logs, the under side of boards or any soft wood lying on the ground, for she always avoids wood in an upright position. The wood must be firm enough to keep the eggs in place, and soft enough to absorb sufficient moisture to aid in hatching them.

About fourteen or sixteen eggs are laid in each nest, and are placed aslant, one upon another. To accommodate these, the insect bores a hole about an inch long by an eighth of an inch in diameter. The apparatus with which these holes are made seems quite incapable of such a task. It consists of a pair of horny hooks, at the extreme end of the insect's body. These hooks diverge at the tips, one scraping upward, the other downward. They appear to be about as suitable for boring into wood as a bent pin, yet the holes are perfectly round and as smooth as if bored with a fine auger.

While performing her task, the female is most of the time apparently motionless, the action of the tail scrapers being, of course, concealed. The eggs are packed in dust in the completed holes. Then the upper part of each hole is filled with a frothy material which flows from the Locust's body, and finally the top is padded with a thick pad, made of a sticky substance from her mouth. This pad hardens and effectually protects the eggs until the early spring, when the increased moisture softens the pad sufficiently to allow the young to push it out or eat through it.

Locusts have been the cause of much suffering and distress, especially in Asia and Africa. Famine and death have often succeeded a visitation of these pests, for, wherever they alight, they eat up every green thing, and cause the ground over which they have passed to look as if it had been swept by fire.



## CRICKETS, GRASSHOPPERS, CENTIPEDES, AND MILLIPEDES

CRICKETS are nocturnal in their habits, remaining all day in their burrows in the earth. At night they feed upon vegetable matter and the noise that they emit is made by the scraping of their legs and wings together. The eggs are laid in the ground where they often remain throughout the winter, and the young pass very rapidly into the form of the adults. The Grasshoppers, as they are frequently called, are in reality Locusts, and are especially destructive to vegetation. The Centipedes and Millipedes are branches of the Myriapoda, a term which means numberless legs. They are to be found under logs and stones. The Centipedes live upon small animals which they poison by means of the spines found at the tips of the first pair of legs. Large species such as the Tarantula are to be found in tropical climes, and their bite is extremely painful and poisonous, but not necessarily fatal. It lives in a nest built very similarly to that of a bird. The legs of the Centipede are quite long in comparison to the body. The Millipedes or Thousand Legs are shaped very like the caterpillar or an earthworm, and their legs are relatively very short. They are often called cutworms on account of the damage which they do to growing crops. When they are attacked, they curl themselves up into a coil and protect themselves by emitting a fluid from their bodies which by its offensive odor renders them unattractive to their enemies. There is a pair of antennæ upon the head, a pair of eyes, and two or three pairs of mouth appendages; so that while the body is worm-like and consists of a number of segments, which would make it resemble the worms, the other portions of its body cause it to be classed with the Arthropoda.

## CRUSTACEANS

THE Crab and the Lobster are familiar members of the family of animals to which the name "Crustaceans" is given. This name comes from a Latin word which means crust, and the creatures to which it is applied may be called crusted, or soft-shelled, water animals. In some respects they are similar to very large insects, for they have several pairs of legs, and a Crab, for example, looks like a sort of huge spider. The crust, or shell, which covers their bodies, is horny, but is not stony, like the shell of the oyster. The Crustacean casts off his shell at intervals, as the snake sheds his skin, and if he

is caught by one of his limbs, he can break it off and make his escape. In time a new limb will grow to take the place of the lost one. This resembles the way in which the lizard breaks off his tail, without suffering any injury therefrom.

The greatest number of Crustaceans are found in the sea, although some varieties live in fresh-water rivers and lakes, and a few on land. Some kinds can breathe only air, while others breathe both air and water. Those which live on land, however, require moisture, with which to wet the gills through which they breathe.

All Crustaceans have well-developed senses of touch and sight, and some of them smell and hear. Some move forward, as nearly all animals do, but others, like the Crab, move backward or sidewise.

A few of the Crustaceans eat vegetable food, and others live on the blood of other animals, to which they attach themselves, but the greater number are flesh-eaters. The female lays eggs, which she carries attached to some part of her body until they hatch.

In the waters of Japan, an enormous animal of this family is found, whose legs sometimes stretch across a space of twenty feet, but the largest Crustacean with which we are familiar is the Lobster. Some of the shellfish are so tiny that they can be seen only with a microscope, and millions of them inhabit a single pint of water. They are so numerous in some parts of the ocean that they give the water a red color, so that it looks almost like blood. The mackerel, the herring and other sea fish like these tiny creatures for food, and even the great whale feeds on them. He takes in myriads of them, together with several gallons of water, at one mouthful, and when the water is strained out through his fringes of baleen, or whalebone, he swallows the shellfish with apparent relish.

Some of these tiny animals are parasites—that is to say, they attach themselves to larger animals and feed on their blood. They are often found living on the gills of fishes, such as the cod, and the sprat, and, in the case of the latter fish, they sometimes cover his whole head. The sprats so infested are called “lantern sprats,” for the bodies of the little shellfish shine in the darkness. It is said that these “lantern sprats” are always the leaders of the shoals of sprats, as they travel from place to place in the water.

Most of us have seen the little Barnacles that fasten themselves on the piles of a wharf in sea-water, or on the rocks, between the marks of high and low tide. They are also found by thousands on the bottoms of ships, where they are very troublesome, for they prevent the ship from traveling through the water at as high a rate of speed as she would otherwise attain. The Barnacle has a conical shell, which is quite hard and is sharply pointed, as you know if you



have walked on rocks covered with these little creatures. He has only one eye, and no heart, but he has six pairs of long, feathery feet, which he thrusts out into the water and moves up and down, in order to create a current that will bring within his reach the tiny creatures on which he feeds. Some Barnacles attach themselves to large animals such as the shark, whose skin is covered with them. Some species have a sort of a stalk, by means of which they suspend themselves from floating objects, and so hang down in the water.

The Lobster has a rounded body, four pairs of legs, and a wide, six-pointed tail which ends in a rounded fin. His head is small, and his eyes are set at the ends of two projections which grow from his head. He has four antennæ, or feelers, one pair of which are very long and slender, while the other pair are short and thick. His two great claws, which are joined to his body in front of the legs, are very strong, and are the Lobster's weapons of assault and defense. He can open and shut these claws like pincers, and when he grips any object with them he clings to it with the tenacity of a bulldog. The inner edges of one claw have blunt, tooth-shaped projections, while those of the other, which he uses for cutting food, are like the teeth of a saw. If the Lobster is held by one of his claws, he can break it loose from his body, and thus escape without serious injury, since a new claw soon replaces the old one. He is very pugnacious, and often fights hard battles with those of his own kind, or with other animals.

The Lobster lives at the bottom of the sea, near the shore, where he hides among the rocks. He feeds on fish and other animals, and is a good scavenger, for he eats decaying matter as well as fresh. He generally moves forward slowly, but, by means of his tail, can dart backward very swiftly, and can go as far as twenty feet at one leap.

Each year the thin shell about his body splits open along the back, and he shrinks in size so that he can pull the flesh of his claws from their harder covering. Before this occurs, a new shell forms beneath the old one, but for several days it is soft and tender, and for a short time after shedding his shell the Lobster is unable to defend himself. It is not long, however, before the new shell hardens and becomes even stronger than the old one.

If asked the question, "What is the Lobster's color?" most of us would reply, "Bright red, of course; everybody knows how a Lobster looks!" But if you should look for a red Lobster in the sea,—a live, red Lobster,—you would never find one. In his natural state, the Lobster is blue-black in color, with a clouded or mottled appearance, but when caught, he is thrown alive into boiling water, and it is this that changes his color to red.

Lobsters are caught in a trap, or "Lobster-pot," which is a sort of basket that is baited with meat, and is so made that when the Lobster goes in to get the meat he cannot get out. These Lobster-pots are anchored to the bottom of the ocean near shore, where the Lobsters live. Individuals of this species have been taken which weighed forty to fifty pounds, but in recent years the demand for them in market has been so great that they are caught before they are full grown, and those we now see in market seldom weigh more than three or four pounds. On the New England coast, where the Lobsters have always been more abundant than elsewhere, it has been found necessary to pass laws prohibiting the taking of small Lobsters, for otherwise the species might soon become extinct. The flesh of the Lobster is tender and of delicious flavor, but it is very rich and is not easily digested.

The Crawfish, also called the Crayfish, is a crustacean which grows to a length of about three or four inches, and is much like a little lobster. He burrows in the earth on the banks of fresh-water streams, and is so persistent a digger that he has been known to do much damage to the great levees of the Mississippi River. He goes into the water in search of his food, which consists principally of fishes and little mollusks. In Europe large numbers of Crawfish are eaten, but they are seldom used for food in this country.

The Shrimp is similar to the lobster in his habits, and to some extent in his general form. His body, which is from two to six inches in length, is white, dotted with black; and he looks so much like the sea sand, in which he burrows, that he is not easily seen. The flesh of the Shrimp is delicious food.

Of the many different kinds of Crab, one of the most interesting is the Hermit Crab, which is very much like the lobster in form. He lives in a home of his own, which he always carries with him. This house is the shell of some mollusk, and the Hermit Crab selects it for a residence without the permission of the owner. He backs into the shell and holds himself there by means of two hooks on his tail. He lives on the land as well as in the water, and wherever he goes he drags his house with him. His claws and legs point forward, so that ordinarily they all protrude from the opening in the shell, but if he is attacked he draws them in, and closes the opening with his large claw. When he grows too large for the first shell, he finds a larger one and moves into it.

The common Crab, which is found near the shore in salt water, has a flattened, oval body, four pairs of legs, and a pair of strong claws in front. His color is bluish black and he weighs only a few ounces. He is an active and greedy animal, and his favorite food is



decaying flesh. When first hatched, the Crab has a globular body, which is protected by long spines, but he has no claws or legs. He is provided with a fan-like tail, which he uses to assist him in swimming. He sheds his skin several times within a short period, and each time that he does so he increases in size and his form changes. Flat legs, which serve as paddles, appear near his tail, and sometime later his other legs and his claws come into use. Finally, he loses the paddle-like legs which he used for swimming, thus developing into a full-grown Crab, and thereafter he lives on the shore, or on the bottom, beneath the surface of the water. He now sheds his shell but once a year, and it is at the time of shedding, when his new skin remains soft for some time, that he is called a "soft-shelled" Crab. The soft-shelled Crab is fried and eaten, claws, legs and all, and is esteemed an attractive table delicacy. When caught with his hard shell on, the flesh is removed from the shell, and is eaten in the same way as that of the lobster.

The little Fiddler Crab has two claws, like other Crabs, but one is very much larger than the other. Sometimes the right claw is the larger and sometimes the left. He carries this large claw in front of him, in much the same way that a violinist holds his bow, and it is from this fact that he gets his name. The Fiddler Crab digs holes in the sand, in which he buries himself, and he can scurry about so actively, and is such a rapid digger, that it is hard to catch him before he disappears in the sand.

The Oyster Crab is a tiny creature, about twice as large as a pea. He makes his home in the shell of an oyster, and feeds on the minute animals that live in sea water.

The Palm Crab, which is found in the Pacific Ocean, climbs coconut palm trees to get the nuts. He inserts the tips of his claws in the holes at the top of the coconut, and, holding it in this manner, breaks the shell of the nut against a stone, so that he can feast on the kernel. He also uses the husk of the coconut to line the burrow in the sand in which he lives.

The Mountain Crab, or Black Crab, which is found in the West Indies, sometimes lives two or three miles from the sea, but, like all land crabs, he requires a certain amount of moisture. In April and May, these Crabs visit the sea to spawn. They travel in companies, which sometimes number hundreds, or even thousands, and move in a straight line, turning aside only when they come to a wide river or other obstacle. These Crabs make their homes in burrows in the ground, which they seldom leave during the day, but they come out at night and are then very active. They are not flesh-eaters, but live entirely on vegetable food. They are not pleasant objects to look at,

but their flesh is good to eat, and the spawn, which is deposited in a lump as large as a hen's egg, is said to be delicious.

Several varieties of the Crab are found in our fresh-water lakes and rivers, but all of them are small, and they have no notable characteristics.

## MOLLUSKS

WHEN you hear people speak of a "Shellfish," you may know that they mean Mollusks. Shellfish is not a correct name for these animals, for they are not fishes and some of them have no shells. But the word Mollusk means soft, and is a suitable name for them because they have soft bodies.

Some of them live in the sea, some in rivers and ponds, and others on the land. The Sea Mollusks are found in all parts of the ocean, some near the shore and others in deep water. Some remain in one place as long as they live, and others move about freely. Land Mollusks are found in damp, shady places, on trees, on rocks or in the ground.

Some of the Mollusks have fine, silky threads, by means of which they attach themselves to rocks, or other objects in the water; others move about by using the stomach as a foot; others swim by opening and shutting the halves, or valves, of their shells; and others have long arms, by means of which they walk and swim very swiftly.

Mollusks lay eggs, sometimes as many as five hundred thousand. These eggs are carried about in the Mollusk's shell, or buried in the sand, or held together in a long ribbon, which is attached to a stick or seaweed, according to the varying habits of the several species.

Whether the Mollusk has a shell or not, his body is covered with an envelope which is called a mantle; in those which have shells, the mantle is very thin and transparent; Mollusks without shells have a thick, leathery mantle. The shells of Mollusks are very interesting and many of them are very beautiful. It should be remembered that the shell is not a house which the Mollusk can enter or leave at will, as the hermit crab does with the borrowed shell in which he makes his home; the shell is a part of the animal, and he is attached to it. It is just as much a part of him as the foot is a part of the human body. Some Mollusks are called Univalves, which means that the valve, or shell, is in one piece, like the beautiful shell of the Murex, which you will find on another page; other Mollusks are called Bivalves, which means that the shell is in two parts. The Oyster belongs to this class.



The shell of the Mollusk is formed by the mantle which envelops the body. In the edge of the mantle are found tiny bits of soft matter, which are deposited on the outside of the mantle and there harden. This makes the shell grow broader and longer. The outer surface of the mantle furnishes the material which increases the thickness of the shell, by the deposit of successive layers, in the same way. In the edge of the mantle are little glands, which hold coloring matter, and from these come the beautiful tints, which are found on Mollusk shells. There are no color glands in the surface of the mantle, so the inside of the shell, against which the mantle lies, is pure white.

Sometimes the Mollusk has a shell inside his body, but none outside. The Mollusk has no bones, or skeleton, like the fishes and mammals.

Some Mollusks eat vegetables, and others, animal food. There are Mollusks which can attack and devour fishes, and even men; the great Squid is one of these. But Mollusks, like the Oyster and the Clam, must be satisfied with the particles of food matter which come to them from the currents of water which flow through their bodies.

Mollusks are divided into several classes. Those of one class are called the Head-footed Mollusks, because their feet grow from the head; those of another class are called Stomach-footed Mollusks, because they use the stomach as a foot, by means of which to walk; others have no head and are called Headless Mollusks; others are called Arm-footed Mollusks, because they have organs which are used as both arms and feet.

The Cuttlefish, the Poulp, the Octopus and the Squid are animals of similar form and habits, which belong to the class of Head-footed Mollusks. The Giant Squid, or Devilfish, has a short, round body, with a large head, in which are two enormous eyes. He has a sharp beak, like that of a parrot, and from his head grow eight, and in some species ten, long arms or tentacles, each of which is several times as long as his body. On the inner surface of these arms are rows of disks or suckers, by means of which he can take firm hold on any object. This strange looking animal lives near the shore and crawls about among the rocks, seeking fishes and other animals for prey. The color of the Giant Squid varies; in shallow water he is generally yellowish green, but in deeper water his skin becomes almost black. By ejecting water from his mouth he can dart backward very swiftly in the water. He walks on the bottom, using his long arms as feet. When attacked, he ejects from his mouth an inky fluid which darkens the water and conceals him from sight. The Giant Squid has been known to attack divers in the water and even fisher-

men in their boats. As his arms are sometimes ten or twelve feet in length, you can see that they are terrible weapons. He can throw them about a man's body and the sucking disks hold the man fast, while he draws his victim within reach of his terrible beak.

There are many smaller kinds of Squids and Cuttlefish, some of which are but a few inches long and are used as bait for fish. From the body of the Cuttlefish is taken the chalky substance known as "cuttle-bone," which is given to canaries. The substance called sepia, which is used in painting, comes from the body of the Squid, and is the source of the inky fluid with which he darkens the water.

The Nautilus is one of the Head-footed Mollusks. He is found in the warmer oceans, and has a very beautiful shell, which is divided into a great many chambers. Oliver Wendell Holmes wrote a charming poem about the "Chambered Nautilus," which begins with these lines:

"This is the ship of pearl, which, poets feign,  
Sails the unshadowed main."

It is well worth while to read the complete poem. The beautiful, pearly-tinted shell of the Nautilus is rolled into something like a coil. From its opening the head of the animal projects, and from the head grow a great many arms, or tentacles, by means of which he swims or catches his food. His eyes are fixed at the end of two long stalks. He has a sharp beak, with which to tear his food, as the Squid does, but he has no ink and is a small and inoffensive creature.

Nearly all the Stomach-footed Mollusks have a shell, and as it is in one piece, they are called Univalves. From the head grow a number of small tentacles, and they have also a tongue, on which are many rows of tiny teeth. One of the Mollusks has been found to have twenty thousand teeth on his tongue. Some of these animals feed on vegetable matter; others attack and devour Mollusks much larger than themselves. To get at their prey, they bore a hole in the Mollusk's shell with the toothed tongue, which serves as a file, and then suck out the soft parts of the victim, who, having closed the entrance to his shell, believed himself secure.

The Murex is one of the Stomach-footed Mollusks. There are many kinds of Murex, and most of them are found in the tropical seas. From the pictures on another page, you can see the various forms and colors of this Mollusk. It was from the Murex that the ancients obtained the famous dye which produced a matchless purple. This purple dye was so expensive that only very wealthy persons could have garments dyed with it, and these were, for the most



part, kings and princes. In many books you find allusions to "imperial purple," and the heir to a kingdom is said to be "born in the purple."

The little Sand-snails, which we find in our gardens, are univalve Mollusks. Probably you have seen them, with their long "horns," which are really the stalks at the end of which are their eyes. These snails breathe air, but there are sea-snails and river-snails which breathe water and live altogether in that element. Some snails live in damp places, and you may find them under stumps or board-walks. When the snail takes a walk, he carries his shell on his back. If you touch him, he quickly draws his body into his coiled shell, so that you see his flesh only at the opening. When winter comes, the snail coils up in his shell, builds a door of thin skin across the opening and goes to sleep. When spring comes, he stirs himself, and goes abroad for food. But snails have been kept two or three years, and although they did not once leave their shells, or take any food, at the end of that time they came out as well as ever. The snail lays her eggs under a stone or board, and leaves them by themselves to hatch. In a month or so the young snails appear.

The Cowry has a rounded, oval shell, as smooth and hard as porcelain, which is adorned with lines or spots. Some are as large as your hand; others are no larger than a penny. The edges at the opening in the shell, on the under side, are delicately ribbed or fluted.

The Conch has a large, spiral shell, on which it is possible to blow a loud blast, with a mellow tone like that of a horn.

The Oyster and the Clam are classed among the headless Mollusks. They are bivalves; that is, the shell is in two parts, hinged together at the end or the side, and these animals can open and close their shells at will.

The Oyster lives near the shore, in warm and temperate waters, throughout the globe, but is not found in the cold seas. The Oyster does not move about as the univalves do, but remains in one spot for life. His under shell is fastened to the rock, or the bottom of the sea, and sometimes to another Oyster, so that one lives above the other. There are fifty or more kinds of Oysters; the shell of the common variety is four or five inches in length. It is irregularly shaped and rough and scaly on the outside, but inside it is smooth and white. Oysters are found in communities, and the place where one of these communities is found is called an Oyster-bed. By taking living Oysters from one place and putting them down in another, a new Oyster-bed may be established, for these animals multiply rapidly. A single Oyster is said to produce from a quarter to half a million eggs every

year. The spawning season is in May or June, and for some time thereafter Oysters are not good for food; from this fact it has come to be said that Oysters should not be eaten in the months which have no "r" in their names. The Oyster's body is a soft, pulpy mass, of a gray color. In it you find a little hard substance, like gristle; this is the muscle by which the Oyster is attached to his shell. The dark greenish matter serves as a liver, and the crimped edges are the gills through which the Oyster breathes. He has no eyes and no head. He eats tiny forms of animal life. When kept in captivity, he is sometimes fed on corn meal.

In some of the warm seas are found Pearl Oysters. The shell of the Pearl Oyster has a lining of white, beautifully tinted with the colors of the rainbow, and this is called mother-of-pearl. When a grain of sand or some other tiny hard substance gets inside the Oyster's shell, layers of pearl are deposited about it, and it increases in size, as the Oyster grows. Some pearls are, therefore, small, when they are taken from the Oysters, and others, which have remained undisturbed for a long time, are large. These pearls are valued as gems and are worth large sums of money. Those which are regular in form, that is, round, oval or pear shaped, are most valuable. Pearls vary in color and are white, yellow, blue, black, or of other tints. From the layers of mother-of-pearl, taken from the shell of the Pearl Oyster, are made buttons, the sticks of fans, the covering of opera-glasses and other beautiful things.

The Clam is another familiar bivalve. Some Clams live in fresh water, but those which are so delicious for food are found on the shores of the sea. The Clam has a thinner and more regularly shaped shell than the Oyster; the surface is slightly rough. This animal has two tubes which he thrusts out between the halves of his shell. The water flows in at one of these tubes and carries air and food to the Clam's body; through the other tube the waste matter passes out. The Clam does not live at the bottom, on a rock, as the Oyster does, but burrows in the sand to a depth of ten or twelve inches. When you walk along the beach, at low tide, you see little holes, which are the openings to the Clam's burrows. The pressure on the sand caused by a person's footstep alarms the Clam, and he draws his tubes back into his shell so quickly that the water in his body is thrown up through the hole in the sand and rises in a jet. The Clam hunter sees this jet and promptly digs the Clam out of his burrow.

The Scallop is a little animal which is also called the Pecten, because that word means comb; and the shell of the Scallop, which is fan-shaped, is fluted, and the ridges resemble the teeth of a comb. Scallop-shells were formerly used as dishes in which to cook



Oysters, and "scalped oysters" is a phrase which originated in this way.

Oysters, Clams, Scallops and Mussels are the Mollusks most used for food, and in dredging and digging them for market, thousands of people find employment.

There is a kind of Mollusk called the Ship-worm, which is long and soft, like a worm, and bores his way into timbers, below the surface of the water. In this way he sometimes perforates the piles of a wharf or bridge, so that the structure may be crushed by an unusual weight or heavy jar; and he has caused the sinking of a ship by boring into the planks of its bottom. To prevent this, thin plates of copper are fastened to the bottoms of wooden ships. As he bores his way into the wood, the Ship-worm forms a tube of shell, through which the tubes that give him air and food are extended beyond the wood.

The Arm-footed Mollusk has a long arm, by means of which he holds fast to a rock or some other object, and his shell is not attached to the rock. The animals of this class live in both cold and warm waters, and at a much greater depth than other Mollusks prefer.

Then there are the Cloaked or Tunic Mollusks, which have no shell, but a tough skin which surrounds the body, more like a bag, however, than like a cloak or tunic. Some of these Mollusks are no larger than a bean, and from that size they vary up to the size of a base-ball. One of these Mollusks, called the Salpa, is a remarkable animal. The Salpa has a long body, like a tube, and the water flows in at one end and out at the other. By swelling up and admitting a large amount of water, which is held in by a valve, and then contracting himself and forcing the water out rapidly at the other opening, the Salpa can move in the water and swim where he will. Some of the Salpas are less than one inch, and others are more than ten inches, in length. Some of them live singly and others are found in long chains, several inches, perhaps several feet, in length. Each Salpa in one of these chains produces a Salpa which lives by himself, and this Salpa, in turn, produces a number of Salpas which live in a chain.

The Moss Mollusks are tiny animals and live in clusters. They live on rocks or on seaweed, where they present the appearance of a fine network. Some kinds form very beautiful and delicate corals.

While the Mollusks that live in fresh water are not so numerous and do not present so many beautiful forms and colors as those that live in the sea, they are very interesting little animals, and you cannot do better than study those you may be able to find in the brooks and along the shores of the ponds near your home. When you have an opportunity to visit the seashore, you will find many beautiful specimens, whose shells may be kept for your cabinet.

## WORMS

IT MAY seem to some of you that there can be no charm in reading or studying about the worms that squirm and creep through the soil; but to one who recognizes the purpose running through the works of nature, the homely little worms are not without interest.

You may be inclined to believe that worms are all very much alike, but many varieties of worms are known and they show many differences in appearance and habits. Some worms climb trees, others never leave the ground; some live in the mud at the bottom of rivers and ponds, and others in the sea. Worms differ in size, in color, in length of life, and in many other respects. At least twenty different species of the earthworm alone have been found.

You will be surprised no doubt, when you are told that the common little earthworm, which you believed to be useful only as bait for fish, serves another and more important purpose. We have the authority of eminent scientists for the statement, that he plays an indispensable part in the formation of the soil.

By burrowing in the earth, he turns the soil over and over, keeping it in a fertile condition. The little holes which he makes let in air and light to damp places, and by bringing to the surface the finely powdered earth he consumes in his burrowings he enriches the soil. Very little effect is produced by each little worm, but there are such immense numbers of worms, that we can easily appreciate the importance of the part played by earthworms in cultivating the soil.

The earthworm has a long, round body, and in temperate regions it measures from three to six inches in length, while in warmer countries it attains a much greater length. His body is made up of numerous segments or rings, as many as three hundred sometimes being found in the body of one worm. A very remarkable thing about the worm is that if a part of these rings are cut away from the others, he has the power of replacing them, if not entirely, at least in part.

If you examine the earthworm closely, you will be surprised at not seeing legs, eyes, or ears, and you may wonder what means he has for making his way through the ground. Look again, however, and you will observe on each ring of his body four pairs of bristles, or spines, which stand backward. These are the means of locomotion with which nature has endowed the earthworm.

When an earthworm crawls along over the ground, the fore part of his body is first pushed forward, then the fore part holds to the ground while the hinder part is drawn up by the closing of the rings,



like the bellows of a concertina; then the fore part is again pushed forward, and so he continues to travel onward.

The earthworm makes his burrow or nest in a hole which he digs in the ground. Since he has no other means of digging, he must dig with the hole which serves for his mouth. This hole has the power of drawing or sucking in, so the earthworm eats the soil as he goes burrowing down and passes it through his body, forming at the top little heaps of earth, known as worm casts.

The tube in which he lives proceeds vertically downward from three to six feet, and in some instances it extends some distance horizontally. More frequently, however, it terminates without bending. If you look into one of these little holes you will see the worm quite near the surface with his head upward. At night he comes out of his dwelling to go in search of food. He seldom leaves his nest entirely, however, but leaves his tail sticking in, so that if he is disturbed he can quickly draw himself in again. He feeds upon vegetable material, especially that which is already decayed, such as fallen stems, leaves, and small branches, but he never injures growing plants.

The eggs of the earthworm are laid in the ground in cocoons. A peculiar fact, that has been noted in connection with these eggs, is that, at times, two worms hatch from one egg. When the little ones hatch out, they resemble the adult worm except in size, but they cast their skins at intervals, and at each casting more rings are added, thus enlarging their bodies.

Earthworms are pursued by many small animals who use them as food. The little moles that live in the ground are their chief enemies, but woodcock and other birds feed upon them, as do frogs, toads, and even fishes.

In winter the earthworms line their nests with leaves to keep out moisture, and remain dormant until awakened again by the warmth of spring.

In streams and ponds of fresh water, you can often find a member of the worm family, known as the leech. Sometimes you may find this little creature in the sea, but this is not a very common occurrence and you are more likely to find him in the ponds or streams.

The body of the leech is segmented or made up of parts like that of the earthworm. He has a sucker at each end of his body, the one at the head being armed with biting jaws. The body of the leech is usually flattened and is broadest toward the tail, but it tapers at each end. His color is usually dark, but variously mottled, striped, or dotted, with lighter colors.

He is a very hungry creature, and feeds upon animals, frogs, and fishes, sucking out their blood and soft parts. He is so voracious that

he sometimes devours a member of his own family. When cold weather sets in, the leech buries himself in the mud, at the bottom of the ponds and streams, sleeping until spring, when he crawls out of the mud and swims about again.

No doubt you have heard the old story about hairs from horses' manes or tails falling into water and changing into worms. This is not true, but the idea arose from the fact that the *Gordius*, or hair-worm, is so extremely slender, that he resembles a horsehair. This worm is also an inhabitant of ponds or streams.

The hair-worm lays her eggs in long chains in the water or in some moist place. When the young are hatched, each eats his way into the body of some insect *larva* and remains inclosed there, until, as is often the case, he is eaten by some larger insect, usually a water beetle. In the body of the water beetle, he lives until he becomes full grown, when he comes forth into the water.

The worms which inhabit the sea are by far the most beautiful among the worm family. Among them we find wonderfully beautiful creatures, whose colors are as brilliant and whose hues are as varied as the many-tinted flowers of the garden. While some species of sea-worms are free and move about from place to place, burrowing in the sand at the bottom of the ocean, or swimming about in the water, others cannot move about at all for they live either in beautiful shelly tubes, which are formed around them as they grow, or in tubes which they themselves build from the sand, little stones, and broken shells, which they fasten together by means of a sticky substance that flows from their bodies.

Sea-worms are distinguished from their relations on the land by their breathing organs. In the earthworm there are no visible organs for breathing, but such is not the case with the sea-worm. Those that are free, have their breathing organs, or gills, arranged along the sides of their body, in the form of delicate fringes, or in tufts, which look like little trees; while those that live in tubes have their breathing organs arranged around the head and neck, in the form of collars, plumes, and crests.

Among the number of sea-worms that move freely in the water, we observe one with a coat of silken hairs, these hairs having the brilliant luster of gold, silver, and other metals and reflecting the varied hues of the rainbow. This is the little sea-mouse, one of the most beautiful of worms. None of the birds of the air possesses more gorgeous colors than this little inhabitant of the sea. The sea-mouse is usually from six to eight inches long and from two to three in width.

Upon the seashore you may sometimes see tubes made of shining pearly bits of broken shells, grains of sand, little pebbles of different



colors, with here and there small whole shells. Each of these little tubes was at one time the home of a little worm inhabitant of the sea, named the terebella.

The little terebella has long delicate feelers around his head. He stretches these feelers out as far as he can make them reach, and little specks of sand and bits of shell adhere to them. These he brings together and arranges piece by piece in the form of a circular wall, gluing the parts together with a sticky secretion which comes from his body.

If you can get some of these worms for your aquarium, you will find much to interest and amuse you in watching them build their curious and pretty little houses. Sometimes these terebellæ live together in groups, and the clusters of tubes which they form are quite large.

There is yet another little sea-worm that you will find interesting. He is named the Serpula. This worm makes his home in a white, shelly tube, which is formed around him as he grows. Generally the shells are found in clusters, attached to the surface of a stone, or shell, or to any object that has been a long time in the sea. The tubes are often coiled and twisted, and it is from this coiling and twisting that the little creature gets his name of Serpula. One end of the tube tapers to a point and is closed, but the other end is open, and from it he pushes forth his head to get food.

This head is covered with a cluster of delicate crest-like gills of the most brilliant scarlet and crimson. This color, which is due to the blood which constantly flows through the gills, makes the little Serpula resemble a carnation when in full bloom.

Above the cluster of gills projecting from the head of the Serpula there is a kind of little stem, on the end of which is a flat piece of shelly material. The use of this organ is seen when the Serpula is disturbed, for he then withdraws into his shell, and the little organ serves as a stopper for the top and protects the Serpula from enemies.

## CORAL

CORAL is made by Polyps and not by insects, as has been popularly believed. The beautiful Red Coral, which is like a little tree with branches, is one of its many forms. Great coral reefs, hundreds of miles in extent, are also made by tiny Polyps. When the Polyp dies, his skeleton, which is as hard as stone, remains, and above it lives a new Polyp, until he, in turn, dies, and so on through a cycle of countless years. The Polyp does not labor to build up the reefs, as the coral insect has been said to do; he simply eats, lives a

little while and then dies, leaving his skeleton as a part of the coral formation. In time the Polyp skeletons make a mass of coral which reaches to the surface of the water. Then the dashing of the waves breaks off fragments, which are ground to sand against the body of the reef. In this sand, seeds, carried by birds, find lodgment; trees grow from them; earth mold forms about the coral; and animals and men find a dwelling place upon the island, which had a beginning ages before, in the skeleton of a little Polyp at the bottom of the sea. Coral and coral reefs are found in rocks hundreds of miles from the ocean, and from this we know that part, at least, of our land was once under the sea.

## JELLY-FISH

THE Jelly-fish has a soft body, of rounded form, closely resembling jelly which has been "formed" in a bowl—hence its name.

From one side grow long tentacles or fingers. If you touch one of these innocent-looking creatures, you will feel a very painful smart or sting, like that which follows contact with the plant known as the nettle. For this reason the Jelly-fish is also called the Sea-nettle. The stinging sensation is produced by tiny, hair-like organs, which are coiled in minute cells in the tentacles when not in use. He throws them out to catch little animals on which he feeds, or to defend himself from his enemies. At night the Jelly-fish sheds a brilliant phosphorescent light, and the water often sparkles and shimmers with wondrous beauty, because of the thousands of Jelly-fishes floating near the surface.

There are many kinds of Jelly-fishes. One is called the Comb-bearer, because on his egg-shaped body are several rows of fingers which resemble the teeth of a comb. He has also two very long, fringed tentacles. These are constantly changing their form and color, and are very beautiful. This species is usually three or four inches in length.

## MEDUSA

The Medusa, or Disk Jelly-fish, is shaped something like an umbrella, with a fringe around the rim. The body has so little solid matter, that when taken from the water and dried, it is but a mere skin. When filled with water in his native element, the animal may weigh several pounds. The Medusa floats near the surface of the water and, by opening and closing his disk, is able to swim slowly from place to place. These creatures live in schools of im-



mense numbers. In tropical waters, where they are more common than along our own coasts, sailors often see myriads of them about a ship. In the daylight they are beautiful with the colors of the rainbow; by night they give off a brilliant light. One species of the Medusa sometimes grows to six or seven feet in diameter, with tentacles a hundred feet long. Most of these animals, however, are small, some no larger than the human hand.

#### HYDRA

The Hydra is a fresh-water Jelly-fish, not more than half an inch long. The body is like a tube, with a mouth at one end, and about it is a fringe, by means of which he catches for food small creatures that live in the water. If his body be cut in two, each half becomes a complete Hydra. Even if you divide him into twenty pieces, each part will grow into a perfect animal; or you may join two Hydras together and they will grow to be one. If a slit be cut near the end of the Hydra's body, a head will grow there and as many heads will grow as there are slits made.

#### PORTUGUESE MAN-OF-WAR

One of the prettiest of the Jelly-fishes is the Portuguese Man-of-War. He is really many animals in one, for a little community of creatures cling to an air-sac which floats on the water and keeps them up. The air-sac is thin and has very delicate shades of blue and purple, with a fringed crest of rosy color. The tentacles, which hang from the air-sac, are sometimes twenty or thirty feet long. Some of these are used for swimming, others for catching food and others to produce new Jelly-fishes. They can sting severely, and will at once grasp a hand or other object which is placed in the water near them.

#### SEA-ANEMONE

Polyps are sea-flowers,—that is to say, they look much like flowers, but they are really animals. The Sea-anemone is one of the familiar forms. He has a body like a tube, with an opening at the top which serves as a mouth, and around it is a fringe, resembling the petals of a flower. By means of his base, or feet, the Sea-anemone clings tightly to the rock, and it is very difficult to remove him without tearing him into pieces. If you touch this creature, he withdraws his tentacles, or fringes, and shuts up his body so that it looks like a

dome. He eats sea-snails and other animals that come within reach of his tentacles. The eggs of this animal are called "buds" by naturalists. If you cut a Sea-anemone in pieces, each piece becomes a complete animal, as in the case of the Hydra. Where the Anemones grow in profusion, the appearance is like that of a veritable flower garden.

#### SEA-PEN AND SEA-FAN

One species of Polyp is called the Sea-pen, because in shape he resembles a quill pen, or feather. He is fixed in the sand by means of his long stem. Some of the Sea-pens are red, some purple, and others orange, and all are very beautiful.

The Sea-fan is a kind of Polyp that is formed like an extended fan, the webbing composed of a network of fibers.

#### SPONGES

UNTIL within comparatively recent years, the Sponge was regarded as a plant; it is now known to belong to the animal kingdom, and to the order *Spongida* of the class *Rhizopods*. Sponge is an elastic, porous substance, formed of interlaced horny fibers, which produce, by their numerous inosculation, a rude sort of net-work, with meshes of unequal size, and, usually, of a square or angulated shape. Besides these pores, there are some circular holes of large size scattered over the surface of most Sponges, which lead into sinuous canals that permeate their interior in every direction. The oscula, canals, and pores communicate freely with each other. The characteristic property of the Sponge is the facility with which it absorbs a large quantity of any fluid, more especially of water, which is retained amid the meshes until forced out again by a sufficient degree of compression, when the Sponge returns to its former bulk. From this peculiarity, combined with its pleasant softness, arises the value of the Sponge for the purposes to which it is applied. In domestic economy and in surgical practice, there is no other product that can be satisfactorily substituted for it.

Sponge is an aquatic production, found growing in almost every sea and on almost every shore. It is abundant and varied between the tropics, but becomes less so in temperate latitudes, and continues to diminish in quantity, variety, and size, as it is traced into European and colder seas, until it almost disappears in the vicinity of the polar circles.



In its natural state, the Sponge is a very different-looking object from the article of commerce. The entire surface is covered with a thin, slimy skin, usually of a dark color, and perforated to correspond with the apertures of the canals. The Sponge of commerce is in reality only the home or skeleton of the Sponge.

There are a few Sponges that inhabit ponds and sluggish rivers; the others are marine. Of these, many of the calcareous and siliceous kinds inhabit the shores between tide-marks, preferring a site near the low ebb, where, nevertheless, they are daily alternately submerged and left exposed to the atmosphere. The figured Sponges, with a fibrous texture, to whatever genus they belong, are denizens of deeper water, and are never left uncovered. They grow usually in groups, on rock, shells, shellfish, coralines, and seaweeds, and either have no power of selection, or the quality of the site is indifferent to them.

In their growth, some Sponges assume a determinate figure, or, at least one whose variations are confined within certain limits. The greater number are irregular and variable, their shape depending in a great measure upon the peculiarities of their site, to which they easily accommodate themselves. They will incrust a shell or a crab, a rock or a seaweed, following every projection and sinuosity. The offshoots will spring up with a more luxuriant growth in the deeper sheltered places, until the original shape of the foundation on which they grow is lost to sight.

Sponges are incapable of voluntary motion and are not sensitive. They remain rooted to the places of the germination and are incapable of either contracting or dilating themselves, or even of moving any fiber or portion of their mass. The functions which distinguish them as living beings are few, and faintly imaged.

Although Sponges lack the power of motion possessed by most animals, being nearly always attached, in one position or another, to some object, the study of their habits in captivity brings out many of their animal characteristics in a striking manner. Small specimens taken from the sea and placed in dishes of salt water, may be kept alive for several hours, if well cared for; and, by using finely-powdered coloring matter, such as carmine or indigo, the manner of their feeding may be readily observed. Sponges are more active in fresh seawater than in stale; they cannot be kept alive out of water and soon die if exposed to the air. Being unable to go in search of food, as a natural result they can grow only in places where there is always an abundance of food suited to their wants.

The great Sponging-grounds of the world are wholly confined within waters having a relatively high temperature during the entire year. The Old World Sponges grow principally in the Mediterranean

and the Red seas; the New World Sponges are found about the Bahamas, southern and western Florida, and parts of the West Indies. The finest Sponges come from the East, but one of the American species, the so-called "sheep's-wool" stands high in favor.

The commercial Sponges are separated into six species, three of which are European and three American. They are all included in a single genus called *Spongia*, and though having much in common as regards structure, their texture varies to such an extent as to make them of very unequal value for domestic purposes.

The Old World species may be arranged as follows, in order of their grade of excellence, beginning with the best quality: The Turkey cup Sponge; Levant toilet Sponge; the horse, honeycomb, or bath, Sponge, and the Zimoca Sponge. The American species includes the sheep's-wool Sponge, the yellow glove, violet, and grass, Sponges. A very close relationship exists between the species of the two continents.

All known regions in which useful specimens abound, contribute to the world's supply. The trade is extensive. The demands upon the fisheries are great. In the Mediterranean, the fishing is carried on in some places at a depth of forty fathoms. Divers, naked or in armor, go to the bottom and tear off the Sponges from their places of growth. In some places drag-dredges are employed.

In the past quarter-century the Sponge fishery of the Florida coast has grown remarkably. Its headquarters are at Key West, and several hundred sailing vessels are engaged in the industry. The fishing appliances consist of a small boat, a long hook, and a water-glass. The hook is in reality a three-pronged spear, attached to a pole thirty-five feet long. In searching for the Sponge, the fishers row about in the small boat. By holding the glass on the surface of the water, the bottom is plainly seen and small objects are readily discerned. When a Sponge is sighted, the pole with the hook attached is shot down and the product deftly gathered. The boat-load is brought to the deck of the schooner, allowed to remain there for a few hours, and is then carried down into the hold. On Friday night, the fishing generally ends for each week, and the vessel sails for some spot on the neighboring coast where there are established crawls, or places for curing the catch. These crawls are from eight to ten feet square, their purpose being to hold the Sponges while maceration and decomposition take place. The resulting refuse is carried off by the tide. The fishermen go away for another catch, and the Sponges are left in the crawls until the end of the following week, when a new cargo is brought in. The returning fishermen beat the decomposed Sponges with clubs, removing the impurities. The



water is squeezed out, and then the Sponges are allowed to dry on the ground. After drying, the hold of the large vessel is loaded to the utmost with product, and the voyage to Key West is made. Buyers from New York look over the Sponges, and make offers for entire cargoes. The fishermen dispose of their goods rapidly and sail away for more. The buyers store the Sponges in a dry building, and cause them to be bleached by lime. A popular manner of bleaching is to wash the Sponges thoroughly in water, and then to immerse them in diluted hydrochloric acid, for the purpose of dissolving any calcareous substance. Having again been washed, they are placed in another bath of diluted hydrochloric acid, to which six per cent of hyposulphite of soda, dissolved in a little warm water, has been added. In this bath the Sponge remains for twenty-four hours, or until the bleaching process is completed. After bleaching, the Sponges are pressed until their bulk is greatly reduced; they are then baled, and shipped to New York, which is the distributing point for the entire Florida product.

Sponges are by far the most important fishery product of Florida, representing about one-third of the annual value of the fishing industry. In 1899 the yield was over three hundred and fifty thousand pounds of Sponges, of which the first value was nearly \$400,000.

## PROTOZOANS

THERE are many thousand varieties of strange sea-creatures which belong to the family of Radiates. The Protozoans are the simplest forms of animal life. They have many shapes: some are like tubes and some like bottles; some are soft, while others have a bony covering. The Rhizopods have root-like feet, by means of which they cling to the rocks. Their shells form limestone, from which are quarried blocks for the erection of magnificent buildings.

## INFUSORIA

THE Infusoria are so tiny that millions of them live in a drop of water. They cannot be seen with the naked eye. All these are animals, which eat and live and die, and all serve some useful purpose in the great plan of creation, just how, we cannot always determine. We know that there is a reason for the existence of each of these seemingly insignificant forms of life, if it be no more than to serve as food for other creatures, which, in turn, are useful to man.

## INTRODUCTION

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WHEN one looks at the plants of any neighborhood, one discovers that their forms are exceedingly diverse. There are the trees, which represent the largest plant bodies; the shrubs are recognizable by their lower stature and bushy, branching habit; then there are the innumerable flowering herbs of all sorts. It is just at this point that many persons are inclined to stop in their examination of plants; but there are numerous other forms which merit study. There are the ferns, which every one knows; also the mosses, which are almost as well known; the lichens are to be found everywhere; the mushrooms and toadstools are conspicuous in certain conditions; while the thready and scummy growths in ponds and streams are certainly familiar to those who have had anything to do with the water. The distance between a green pond scum, floating upon the water, and a great tree, rooted in the soil and raising its branches high into the air, is very great, but there are plants all along the way, and to get any proper notion of the plant growth of a neighborhood, one must include the whole series in his observation.

Another thing to be observed as one examines the plants of a neighborhood is that they are not evenly distributed over the surface of the earth. In some places trees are growing; in other places the plants are chiefly grasses; while in still other places the cat-tails and bulrushes are flourishing. This indicates that the conditions for living are not uniform on the surface of the earth, but, being very diverse, the groupings of plants are also diverse. The fact is that plants are organized into what we have learned to call societies. Each society is determined by certain conditions which will admit some plants and reject others, just as the conditions for membership provide in human society. For example, a given kind of forest is one kind of society, a meadow is another, a swamp is still another; and in each of these cases special kinds of plants are brought together. In field work to-day, we are examining these various societies to determine the conditions of membership, and also to determine what plants are able to fulfill these conditions. One curious fact that is developed in connection with this study is that plants which are very nearly related to one another do not get along together in the same society. This simply means that, being closely related, their demands are so nearly identical that they become most intense rivals. For example, two kinds of aster or of goldenrod are very seldom found growing in the same society, or very near together.

In beginning to examine the plants of a neighborhood, therefore, one should visit them as though he were going into different communities, whose conditions of living and habits differ. One of the first things in a



neighborhood would be to discover how many distinct societies or plant communities are thus within reach. When the principal societies have been recognized, they should be studied from two standpoints, namely, the characteristic plants of each society, and the conditions which determine the presence of these plants. Perhaps it would be helpful to give an illustration or two in reference to the study of plants composing a society.

If a forest society is to be studied, it is not expected that one should make a list of all of the kinds of plants found. It would make a very great difference whether a certain kind of plant was present everywhere over the area, or was represented only by an individual or two. The general character of the society would be determined by the abundant plants and not by the occasional ones. The occasional plant in a society means either an accident, or that the conditions are not very favorable for it, and that it does not really belong to the conditions. Naturally, looking at the plants of a forest, the trees would be the most important, and it should be determined whether the forest is what is called a pure or a mixed forest. In the former case, some one kind of tree would very much outnumber all other kinds. For example, there are pure beech forests, pure oak forests, etc. This does not mean that beech and oak are the only trees in such forests, but that they so far outnumber the other kinds that they give tone to the society. In many regions, however, it is more common to have a mixed forest, which is made up of several kinds of trees almost equally predominant. For example, a mixture of maple, elm, walnut, oak, hickory, ash, etc., is a common mixture in the forests of this country.

If one is living in a city, where there is no real forest society, the trees all being artificially planted, it is very easy to discover vacant lots where plants are undertaking to establish themselves. Such a vacant lot permits one to discover the sort of plants which belong to the conditions, and the dominant ones should be picked out. There will always be anywhere from one to a half-dozen plants most conspicuous in the society, just as there are one to a half-dozen individuals most conspicuous in any human society. It is these predominant plants that are the best indications of the conditions of living, for they are the plants that are most nearly adapted to the conditions.

If the shallow margin of a pond is within reach, it presents during the summer an illustration of one of the most interesting of plant societies. For example, such a pond will be found to be fringed with a thick growth of certain reedy plants which rise up, wand-like, from the shoal water. In most cases it will soon be discovered that these reedy margins are dominated by three types of plants, namely, the bulrush, the wild rice and the cat-tail. Occasionally, ponds with fringes of this sort gradually fill up, the open water disappears, to be replaced by a swamp in which these dominant marginal forms persist more or less. The last to go is usually the cat-tail, which is often found in clumps in the wettest part of any swamp which has replaced a pond.

It must not be supposed that any one area has but a single society during a growing season. In the case of the ordinary deciduous forest,

there is a most interesting plant society which passes through its whole existence for the season before the trees put out their foliage. Any one knows that the favorite place to search for "spring flowers" is in a forest of this kind. Before the foliage is fully developed, so as to cast a deep shadow upon everything beneath, these early spring plants have seized the opportunity to do their work. Consequently, the forest soil is covered with their delicate and beautiful forms, which must put out their leaves and flowers and set their seed, and get through their work for the whole season before the forest leaves catch them with their shade. After the real forest society is in full activity, it is well known that the "spring flower" society has disappeared, and it is simply waiting, just as though it were winter, for the next time to come around when there is a combination of bare trees and a little warmth.

Instead of attempting, therefore, to learn the names of all the plants in any given region, it is far better to recognize first the plant societies or communities in any region, and then to become personally and intimately acquainted with the representative members of each of these societies. These illustrations may serve to indicate the general method of looking at the plants of a neighborhood. If a habit of this kind is formed, every landscape becomes significant. One cannot even pass through a region by train without being attracted to the rapid succession of societies, and if the home societies have been observed, even these glimpses from the car window speak of the conditions which obtain and the probable character of the plants which are present. Such an intelligent view of the earth's surface also has the advantage that it is one which is naturally a part of one's experience, since landscapes are presenting themselves constantly to most people. It remains, however, to make some suggestions as to the study of societies from the standpoint of the conditions which determine them. One may recognize the existence of forest societies, meadow societies, swamp societies, etc., and may know the plants which dominate in each, but one should go farther and ask at least a few questions as to the conditions which determine these various societies.

One of the most prominent conditions is the amount of water presented to the plants. This single factor will make all the difference between a swamp and a desert, so that to determine in a general way the amount of water is one of the first things to be done. It is easy to tell the difference between the deep swamp and the shallow swamp which dries out occasionally, and also the difference between the moisture of the soil of a forest and of a meadow. Another thing to determine is the nature of the soil, and one should learn to recognize the differences among ordinary soils. The soils which one usually meets in connection with plants may be roughly grouped under five heads, namely, sand, clay, lime, humus and salt soils. Most of these names suggest the character of the soil, unless it be the word humus. This means a soil which contains a large amount of decayed organic material. It is always of various shades, from brown to black, and is the kind of soil that one always recognizes at sight as "rich." The important thing to determine in connection with these various soils is their power of receiving and retaining water. Almost



any one can devise a series of experiments by which this can be determined. For example, one may know offhand that a sandy soil receives water remarkably well, but that it retains it very poorly. It is equally evident that a clay soil exactly reverses this character, receiving the water with great difficulty, and retaining it with tenacity.

Another condition to determine in connection with any society is its exposure to light. It has already been shown how certain spring plants have been able to secure the light they need by getting ahead of the shade, but all plants cannot do this and all cannot receive the same amount of light. Therefore, certain forms have learned to do with much less light than others and are known as shade plants. In almost any forest, one comes across these shade-loving plants with broad leaves, that would be utterly unable to stand the glaring sunlight. It is found that in almost any society plants are arranged in strata, and of course it is the highest stratum which receives the most light and the lowest stratum which receives the least. A forest, for example, presents the most strata. If it be an open one, there will be first the trees, then the shrubs, then the tall herbs, then the low herbs, and finally, directly upon the ground, mosses and lichens. If the forest be a dense one, such as a pure beech forest, the shade may be so complete that many of the lower strata have become obliterated, and the forest is what we call bare, there being no shrubs or tall herbs even, and sometimes not even grasses, but merely here and there mosses and lichens.

It must not be thought that any single cause of this kind will determine a society, for it is determined by a combination of causes which are too intricate for one to follow out minutely. What one should learn to recognize in the outset is that, in a general way, water and soil and light and many other things combine to make up the conditions which determine the presence of one set of plants rather than another.

In addition to the study of plant societies in the way that has been suggested, it is always of very great interest to study the habits of individual plants; just as one who is visiting a community for the first time, after he has become acquainted with it in a general way, settles down to note the habits of the individuals. It may be that some who live in cities will be able to study only this phase of the subject, since the parks which are open to them do not represent natural societies, but they present very many plants of great interest in their individual habits. It is absolutely impossible in a limited space to call attention to many of these habits. Certain things may be suggested as worthy of observation, and if these are noted, others will naturally suggest themselves.

One of the notable habits cultivated by many plants is called the underground habit. This means that they possess underground structures in which food is stored, upon which they draw. This is especially prominent, for example, in the spring flowers, to which reference has been made. It will be noticed that almost all of them come from some thick underground part, such as a tuber. This habit enables the plant to retreat completely from any exposure above ground, and to come up again just as quickly when a favorable time returns. If the spring flowers had to

develop from the seeds, they would not be fairly started before the foliage of the forest would overtake and stop them. This underground habit of depositing a store of food beforehand, therefore, enables them to spring up with great rapidity, and to get through their work in a very short season. It is a habit which means not merely protection during the unfavorable season, such as winter, but it chiefly means ability to do a great deal of work in a very short time. Of course the scaly buds upon the trees are for the same purpose. In these protected buds, the leaves of the season are already unfolding. This permits the foliage to appear very promptly when a few favorable days come. It is very interesting to watch the race between the foliage buds of the trees and the spring flowers with their underground food store.

An interesting habit in connection with trees is the fall of leaves and the autumn coloration. It should be noted whether the leaves are broken off, or whether they do not really grow off, no wound being left when they fall. This habit, which is known as the deciduous habit, has been cultivated by trees in answer to an unfavorable season. For example, the leaves when expanded for work are very much exposed and very delicate structures. To protect them through the cold of winter would be a large undertaking, and therefore the trees have learned to drop them and to put out a fresh crop the next season. A habit which contrasts strongly with this may be observed in the case of the pines and their allies. They are called evergreen trees, because the leaves persist during the winter. The pine and its friends have concluded that they will protect their leaves, rather than put out an entirely new crop each season. In order to protect the leaves, however, they are made with a very small exposure of surface, so that they are reduced to needles, and they are also made almost as hard as bone. It is well known that this great reduction of surface, and the hard texture, diminish very much the amount of work which a leaf can do. Therefore this protection from the winter has been at the expense of work, so that when the growing season comes, the protected leaves are not the kind which can do much work. The deciduous trees, however, can have broad and delicate leaves, so that an abundance of work can be done during the working season. I fancy that if one comes to reckon up the actual amount of work accomplished, the balance will be in favor of the deciduous trees.

There are many things to be observed in connection with autumn coloration, but very little is understood as yet as to its significance. Observations which can be made and which will be useful are as follows: What are the conditions of moisture and temperature in those seasons when the autumn colors are brilliant, and in those other seasons in which they are pale? In other words, how do these seasons differ from one another in the conditions for plant growth? Another thing to observe is the time when different trees begin to put on their autumn coloration. Is the time the same for the same kind of tree every season, or is it related somewhat to the increasing chill in the air? Are the red and yellow colors mixed on all trees, or are they sometimes pure? Are they mixed or pure in all parts of a single tree? If not, are these related to the differ-



ent sides of a tree, or to the more exposed and deeper parts of the tree? Such questions, carefully answered for large areas through several seasons, will bring to us much information that is needed.

The relation of plants to light is of very great importance, and may be observed in any region. It is true in general that leaves cannot endure very intense light, and must have various ways of protecting themselves. For example, in almost any region what are known as compass plants may be found, in which the leaves turn edgewise when the plant is in an exposed situation. In turning edgewise, the leaf presents the least exposure to the mid-day sun, and therefore the hottest sun, and its flat faces are exposed to the least intense rays of light, namely those of morning and evening. It was once thought that this pointing of the leaves to the north or south had some mysterious connection with magnetism, but the pointing in those directions is due to the fact that the sun rises in the east and sets in the west, and the flat surfaces of the leaf must face those directions. If one has access to sensitive plants, it will be instructive to note how their leaves move and fold up in response to intense light, as well as in response to a touch. It is well to be continually examining individual plants from the standpoint of their relations to light. How do the leaves of any plant avoid shading one another? If the leaves are in danger of being exposed to too intense light, how do they avoid exposing their surfaces fully to the danger? When an ivy is creeping up a wall, or a woodbine up a tree, how is it that all the leaves are brought over to one side and form a sort of mosaic? It must not be understood that any plant is able to adapt itself completely, but it does the best it can, and, as a rule, averages well.

It is interesting to notice how light not only influences the position of leaves, but how it also very evidently influences the direction of stems. For example, a few plants set in a window so that they are illuminated chiefly on one side will show how strongly many of the stems bend toward the light.

The observation of plants in connection with drought is also important and interesting. When a season of drought comes, plants have all sorts of devices to resist it. The danger is in the leaf exposure, for if the leaves dry out the plant is killed. As a consequence, there is an attempt to fold the leaves together, or to roll them up, or to do something to diminish the surface of exposure.

One does not need to wait the coming of a season of drought to make these observations, for a few plants brought into the house and neglected, so far as water is concerned, will show all of the attempts to resist drought.

Illustrations of this kind might be multiplied indefinitely, and a great deal could be said in reference to the habits of plants in scattering their seeds, in securing the visits of insects to the flowers, in arranging for floating in water, in learning to live in regions which are continually dry, etc. These things, however, will occur naturally as the effort to observe is made. One question will suggest another, and so on until the plants of the neighborhood become a mass of interrogation marks to the intelligent observer.

## BOTANY

*By GEORGE RAYWOOD DEVITT, M. A.*

**B**OTANY embraces the study of everything in the vegetable kingdom, in any state in which it may occur,—from living plants to fossils.

It studies the tissues of the plant, and the anatomy of the several structure forms, under the name of Structural Botany or Vegetable Histology.

It notes the shapes and forms of the varied parts of all plant forms in the department of Morphological Botany.

The studies of the duties of the various organs and the methods by which the process is carried on is classed as Physiological Botany.

The arrangement of plants into groups and their systematic classification is Systematic Botany.

The distribution over the face of the globe is Geographical Botany.

The study of fossilized forms of plants of all ages of the earth's development is Paleontological Botany.

The study of Botany in the ordinary acceptance of the term is confined to the structure, the forms and shapes, and the classification and naming of plants.

The starting-point in the study of all vegetable, as of all animal, matter is the cell. This consists, in its simplest form of young vegetable growths, of a cell-wall of elastic, though firm matter, known as cellulose. This cellulose becomes the woody fiber of trees; the substance of the fibers of hemp and flax, from which rope is made; the essential part of paper, and of cotton. The cellulose incloses a fluid, like gelatin or white of egg, called protoplasm. This contains the nucleus and the cell-sap. The protoplasm is the essential form of matter which provides for future growth. The cell theory of growth was brought forward in 1840, and explains the growth of all vegetable and animal tissues. The cells are of various forms and shapes, varying in size from  $\frac{1}{100}$ th to  $\frac{1}{6000}$ th part of an inch. They have the property of multiplying by division or by budding as they absorb matter from the cell-sap and protoplasm which they contain. Several of these cells may unite end to end and form a tube which becomes one of the vessels of the plant. These cells are seen under the microscope to touch one another but they do not fit together as closely and as intimately as do the large cells in bees' honey. There are intercellular spaces, called vacuoli through which sap and gases may be drawn up by capillary attraction to feed the plant and to add to



its growth. Some plants are made up wholly of cells and have no vessels or tubes. These are called cellular plants and include Mosses, Seaweeds, and Fungi. Others have tubes and hollow hair-like vessels through which the matter is carried to all parts of the plant. These are called vascular plants, and include all the higher forms of vegetable life such as Ferns, and Flowering plants. When the cells touch one another with comparatively broad surfaces, the cellular tissue is called parenchyma. When the cells are pointed at the end and are much longer than wide they are called prosenchyma. The walls of the cells in both cases are uniformly thick. When the walls of the prosenchymatous cells are thickened and much elongated they form the pleurenchyma such as are found under the bark of trees and supply the fiber for ropes made from the under layer of the barks of many trees and plants. The thickening of the wall of cells takes place not uniformly over the surface but in the form of network, rings, or spirals; then the cells are spoken of as reticulated, annular, or spiral, respectively. In some plants, such as the Dandelion, Chicory, Milkweed, which have a little milky juice, the cells run together to form tubes, like veins or arteries in the human body, which carry the milky juice. These are called lactiferous vessels. Much of the nutritive matter is carried also by the intercellular spaces. One of the most interesting substances carried in the protoplasm in the cells is the green coloring matter of the plant. It is called chlorophyll. Plants which contain a great deal of chlorophyll are very green, and the lighter shades and tints are produced by less quantities, or, indeed, by less light and air; for chlorophyll is developed only by sunlight and oxygen. This explains why celery which is banked up with earth so as to shut out the sunlight is white and the tops which have had the light of the sun are green. For the same reason a potato, the top of a carrot or turnip, exposed to the light is green. The chlorophyll is affected in the autumn and produces the varied hues of the autumn leaves by the action of frost and the imperfect supply of oxygen. All other coloring matter in the leaves and flowers of plants is produced by a similar matter known as chromule. Other substances occur in the form of minute grains in cells. Among these are starch, sugar, gum, oils, fats, resins, and wax. To the forms which these substances take are applied the terms crystalloids and raphides. The latter are usually in the form of needle-shaped crystals and are chiefly oxalate of lime.

There is in all plants a more or less distinctly marked covering or outside protection which corresponds, in a measure, to the skin of animals. Botanists have given to this the same terms as are applied to the outer coating of the human body. The covering is called epi-

dermis, under it is the cuticle and then the epidermis proper. These coats are made up of modified cells. The outer layer being more or less hardened and compact for better protection. Just as the human skin is perforated by millions of small pores, so the epidermis of plants has a very great number of minute openings called stomata. These lead into the intercellular spaces. These are more abundant on the under side of leaves. These stomata answer the purpose of the pores of the human body, to give off moisture and vapors, and also the purpose of the human lungs to carry on the respiration or breathing.

Plants, like animals, breathe the air; plants breathe through their leaves and stems just as animals do by means of their respiratory organs. When a young plant is analyzed it is found to consist chiefly of water, which is all removed from the soil; there is about 75 per cent or more of this fluid present, and the rest is solid material. Of this latter by far the most abundant constituent is carbon, almost every atom of which is removed from the atmosphere by the vital action of minute bodies contained in the green leaves. The carbon is taken into the plant as carbonic acid gas. Plants also absorb oxygen, hydrogen, and nitrogen from the atmosphere in different quantities through their leaves, and also by means of their roots. These new products stored are in turn used in building up the different organs of the plant. Plants give off used-up moisture through their leaves, just as animals perspire through the pores of their skins. Calculations have been made as to the amount of water thus perspired by plants. The sunflower, only  $3\frac{1}{2}$  ft. high, with 5,616 square inches of surface exposed to the air, gives off as much moisture as a man.

The stomata act automatically in taking in the gaseous and liquid matter from the air. As soon as the cells, which absorb this food through the cell-walls, are filled they close the openings of the stomata so that no more food matter can enter. As the liquid and gaseous matter is carried to the several parts of the plant, the cells diminish in size and the openings of the stomata are enlarged and more matter is taken in. They number from 200 to 160,000 in a square inch of leaf surface. Aquatic plants whose leaves float on the surface of the water have the stomata on the upper surface of the leaf instead of underneath as all air plants have. The purpose of this is quite evident. The outer covering of plants is supplied with hairs, prickles, spines, etc. These are all grouped under the name of trichomes. If a stem has no hairs, it is said to be smooth, or glabrous. When hairs are present the stem is hairy and pilose. If the hairs are short, downy and soft, it is pubescent. If the hairs are long and weak, it is villous; if long and bristly, hispid or hirsute. If the hairs are cottony, tomentose; if like wool, woolly.



Glands are often present on some part of the outer covering of plants. They are filled with a bitter, acrid oily matter in the rind of the orange. The hairs of the stinging nettle communicate with glands which pour out a stinging fluid into the wound made by the hair. Those upon the Sun-dew and Venus' Fly-trap convey a sticky juice by which flies and other insects are caught and digested as food by these carnivorous plants. The honey of flowers is contained in glands called nectaries, at the bases of the petals.

The organs of plants are divided into the organs of vegetation, comprising the root, stem, and leaves; and the organs of reproduction, including the flower, fruit and seed. The first class is concerned in the growth of the present plant; the second has to provide for future plants, and the perpetuation of the species. The root is often called the descending axis of the plant as it goes down into the earth. One of its first uses is to supply anchorage and a fixed abode for the plant. And for this purpose the root is proportionate in size and depth to the amount of plant surface above the ground. It is estimated that in the case of the oak and some other large trees, there is about as much root surface under ground as there is branch surface above. Its second office is to procure food from the earth. This food is in a liquid state, as plants have not the power of taking in solid food except in the form of solution. The amount of solid earthy matter contained in a plant may be seen from the amount of ash which remains after the plant is burned. The root of a plant often takes in not only the food which is consumed by the plant, but lays up in storage an extra supply upon which the plant may feed at another time. As in the case of the fleshy roots of the carrot, turnip and the like, where the plant does the work of growth only during the first year; while, during the second year, it devotes its energy to the production of seed, and then lives upon the food which has been stored up in the root the first year. The same is true of bulbs. Roots are divided into classes according to the shape. Those composed of fibers are called fibrous roots. This is the common form of most herbs and trees. When the root is compact, long and slender, it is a tap-root. When it is shortened it becomes a conical root like that of the carrot; the fusiform, like that of the radish; or the napiform as in the turnip. When the fibers are matted and entangled it is called fasciculated. When the fibers are enlarged into bulbs or tubers, as in the case of the Dahlia, it becomes bulbous or tuberous.

The stem is often called the ascending axis. It bears the leaves, flowers and fruit, in addition to performing the work of conveying the food to the several parts from the root. Plants are divided into classes according to the nature of the stem. When the stem dies

down each year, the plant is an herb, or an herbaceous plant. If root and all dies the plant is called an annual. If the root lives two years, it is a biennial. If it lives from year to year it is a perennial herb. If the stem is permanent and woody, the plant is a tree or shrub. The stem of a grass is called a culm; of a fern, a stipe. When plants have no stem they are called acaulescent. The points in the stem, whence branches or leaves grow, are called nodes; and the clear portions of the stem between these are the internodes. The space between the leaf and the stem is the axilla, which is the name given to the arm-pit of the human body, where the arm leaves the trunk. Growths of leaves which come out from these points are called axillary growths.

The growing points of plants are buds. These may be either terminal or lateral, according to position. In cold and temperate countries the buds started in one year lie over, dormant, during the winter and burst forth the following spring. At the bud points of trees whose leaves fall every autumn, there may be seen the scar left by the leaf of the previous year. In warm climates, buds often have no covering, and such are called naked. But in cold climates the buds are amply protected, usually by an overlapping of thick bud-scales, like shingles upon a roof, or by gummy substances as in the Balm of Gilead, Spruce, and others; or by woolly substances.

Besides the ordinary branches such as are seen on trees, there are a variety of other branches. Sometimes, as in the case of the Strawberry, they run along the ground taking root at the end. These are called runners. A stolon is a branch that bends down to the ground and takes root. Some branches are underground and spring up at a distance from the parent plant, and grow. These are suckers and are found on the Rose and the Mint.

Spines, thorns, and tendrils are really forms of branches. Stems are described according to their shape as triangular, square, octangular, etc. There are some underground growths which are not roots but modifications of the stem. Such are the root-stocks or rhizomes of the Lily, Water-Lily, Iris, Ferns, etc. These are growths which are partly covered by the earth and send out fibrous roots below and leaves above. The bulbs, tubers of potatoes, and corms of the Crocus and Gladiolus are forms of branches and are not roots.

Stems according to their structure are divided into classes. Those which grow by the addition of layers or rings of new growth on the outer portion every year are called exogens or outside growers. Such are the ordinary trees. Those which increase by the deposit of new growth in bundles everywhere throughout the stem amongst the soft cellular matter are called endogens or inside-growers. Palms are ex-



amples. A third class grows from the top by the union of the bases of the leaves, and are called acrogens or top-growers. The Fern Tree forms examples of this form of growth.

When the seed starts to grow it sends a small rootlet down which is called the radicle. It sends a small growing bud up which is called the plumule. There may be in addition to these either two or one primary leaves which have existed curled up in the seed. They contain the first food upon which the little plant will live until it is strong enough and well enough developed to take food for itself from the air and soil. These first leaves are called cotyledons. If there are two the plant is said to be dicotyledonous, or is a dicotyledon. Nearly all exogens are dicotyledons. If there is only one cotyledon, the plant is monocotyledonous, or is a monocotyledon. They are mainly endogens. If there is no cotyledon, the plant is acotyledonous, or an acotyledon. Such are most of the acrogens.

The parts of the leaf are: the blade or broad portion; the petiole, or leaf-stalk by which the leaf is attached to the branch or stem; and the stipules which are a pair of small leaf-like forms that are often found at the base of the petiole. Sometimes both stipules and petiole are wanting. If the petiole is present, the leaf is petioate; if not it is sessile. If the stipules are present the leaf is stipulate; if not, exstipulate. If the leaves fall each autumn, the tree is said to be deciduous; if they remain, the leaves are persistent, and the trees evergreen. Veins are the arrangement of the fibro-vascular matter in a leaf and serve to give it strength. The chief vein is the midrib. When the others branch off from this, the leaf is netted-veined. When they run parallel, or nearly so, to the midrib, parallel-veined. The margin is the rim or border of the leaf. If it is in one continuous, even line, the margin is entire. If the margin presents irregular, small, tooth-like projections, it is dentate. If these tooth-like projections are regular like saw-teeth, it is serrate. If they are rounded, it is crenate. If the body of the leaf is cut by lines which extend about half-way to the midrib, it is cleft. If the lines of division run farther than half-way, it is parted. If the lines run to the midrib or to the base so as to divide it into parts or leaflets it is divided. If the lines of cleaving, parting or dividing run in towards the midrib it is said to be pinnately cleft, parted, or divided. If they run down towards the base of the leaf, then it is palmately cleft, parted, or divided.

As to the form of the leaf itself, if it is many times longer than wide and runs to a point it is lanceolate. If it is several times longer than wide and rounded at the ends, it is oblong. If it is twice as long as wide, it is elliptical or oval. If it is as long as

wide, it is orbicular or rounded. If it is rounded and broader at the base than at the apex it is ovate or egg-shaped.

Compound leaves are those which are composed of a number of leaflets. If the leaflets are arranged along a petiole or a midrib, as are those of the Pea, it is said to be pinnately-compound. If they are placed at the end of the petiole, as are those of the Horse-Chestnut or the Clover, they are palmately-compound.

. There are many leaves of irregular shape, as those of the Pitcher-plant and Side-saddle flower. Sometimes the bases of leaves grow together so that the stem passes right through the joined leaves as the Honeysuckle or the Boneset. Such leaves are called perfoliate or connate leaves.

The organs of reproduction are the flower, fruit and seed. The parts of the flower are the corolla or usually the colored portion composed of parts called petals; the calyx or green part, composed of parts called sepals; stamens, composed of filament and anther; and the pistil, composed of ovary, style and stigma. If a plant has all of these parts it is said to be complete. The use of the corolla, or bright colored part, is to attract insects. The calyx and corolla together act as protective parts to the essential organs, the stamens and pistil. If the corolla consists of a number of separate petals the corolla is polypetalous. If the petals are all united into one, it is monopetalous. Similarly the calyx may be monosepalous or polysepalous. When there is only one floral envelope it is the corolla that is said to be wanting even though the part that is present be colored. In such cases the flower is apetalous. The filament of the stamen is the slender thread-like part which supports the anther. The anther is composed of lobes which contain the pollen. The pollen is composed of minute grains, which at maturity fall from the anther. The breaking of the anther to allow the pollen to fall out is called dehiscence. This may take the form of cracking open irregularly, or breaking open in a hinge-like way, or by the opening of a pore. The pollen grains vary in size from  $\frac{1}{300}$ th to  $\frac{1}{700}$ th of an inch in diameter. The shape of the grains is very varied. When the pollen is ripe it falls from the anther upon the stigma which is usually the upper portion of the pistil. This stigma is covered with a sticky liquid which has the double effect of causing the pollen grains to adhere to the stigma, and, also, of soaking in through the outer coat of the pollen grain to the interior. The grain of pollen may be best likened to a foot-ball, with an outer protective coat or cover, and an inner elastic one. Inside of all is the fertilizing matter to act upon the ovules in the ovary to produce seeds. The pollen swells up and the inner lining is forced through a weak spot in the outer coat in



the form of a tube which forces its way down through the intercellular spaces in the style of the pistil into the ovary at its base. The liquid contents from the interior of the pollen follow down the tube, and comes in contact with the ovules in the ovary. In time these become seeds. Sometimes the relative positions of the anther and the stigma are such that the pollen cannot fall unaided upon the stigma. Then the plant is dependent upon other agencies such as the wind, or insects, to carry the pollen to its place. The anthers and the honey-glands are so placed that a bee cannot enter the flower for honey without rubbing the pollen upon his body. This is rubbed by him against the stigma of the plant he is visiting or upon the next one that he visits. When pollen is carried from the anther of one flower to the stigma of another flower of the same species, the operation is called cross-fertilization. Nature in many cases favors this form. The dropping of the pollen upon the stigma is called polination. When polination is conducted by insects the plants are said to be entomophilous; when by the wind, anemophilous.

The term fruit is applied in botany to the seed bearing vessels of all plants irrespective of the edible qualities. When the ovules have been fertilized and become seeds, the ovary swells up sometimes to an enormous size, and floral envelopes and stamens wither and fall away. The portion of the ovary which contains the seed or seeds is called the carpel. When a fruit is formed of only one carpel, it is called an apocarpous fruit. When several carpels are inclosed in one fruit, it is a syncarpous fruit. The envelope or covering of all seeds is called the pericarp. The simplest and commonest form of seeds is that of a one-seeded fruit with the pericarp surrounding it, but separable from it. This is seen in plants with minute seeds, such as the Buttercup. It is called an achænium or an achene. If it occurs singly it is solitary, if there are several it is aggregate, as in the Strawberry, where the achenes are imbedded in the edible portion of the fruit. Caryopsis is the name given to a seed in which the pericarp is not separable from the seed. It is the form of the fruit of the Oat, Wheat and Corn. When the pericarp lengthens and flattens out to form a wing as in the Ash or Maple, it forms a samara or key. The nut is a dry one-celled fruit with a hardened pericarp. The drupe is the name given to such fruits as the Cherry, Peach, Plum, Apricot and Date. The stone in these fruits is the putamen. A legume or pod is the fruit of the Pea and Bean. A pepo is a fruit—like that of the Gourd, Melon, Squash and Pumpkin. The pome is the fruit of the Apple, Pear and Quince. The cone is the fruit of the Pine and Spruce. When the seed is covered the plant is called an angiospermous plant. When it is naked, a gymnospermous plant.

## PLANTS

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### PRESERVATION OF FLOWERS AND PLANTS

THE reason why flowers last so much longer on the stem than after they are cut may be very simply explained. While growing on the stem, the large amount of evaporation from the surface of the leaves is compensated for by the supply of moisture from the roots. When cut, this supply of moisture is stopped, while evaporation from the leaves continues. Hence the custom of putting cut flowers into water. But the maimed stems possess only a very limited power of sucking up water, and hence they wither quickly. A certain coolness of temperature, together with a supply of moisture, will keep flowers fresh for a much longer time than the supply of moisture alone, the surface of the leaves being thus exposed to the smallest amount of evaporation by heat, hence the tight, moisture producing receptacles in which flowers are kept by florists.

If you would experiment on a very small scale in keeping out surplus air and supplying moisture, put a rose or bud in a dish of water and set a tumbler over it. To experiment on a larger scale, fill a flat rimmed, porcelain dish with water; in the water set a vase of flowers and over the whole place a bell glass, with its rim in the water. The air surrounding the flowers being confined beneath the glass, will be kept moist by the air that rises from it in vapor, and the flowers may thus preserve all their freshness and beauty for weeks; moreover, the water as it condenses will run down the sides of the bell glass and back into the dish. If means were devised to inclose the water on the outside of the glass, so as to prevent its evaporation into the air of the room, the atmosphere around the flowers would remain continually moist and the flowers keep for an indefinite time.

The following is a well-tried method of preserving flowers for a long time. Dip them, as soon as gathered, in perfectly liquid gum water, and, after allowing them to drain for two or three minutes, arrange them in a vase to your taste. The gum gradually forms a transparent coating on the surface of the petals and stems, and thus preserves their color and shape long after they have become dry and dead.

To restore cut flowers that are faded and drooping, immerse them half-way up their stems in very hot water, and let them remain



in it until it cools. The parboiled portion of the stems must then be cut off and the flowers placed in clear, cold water. Not all flowers, however, will respond to this treatment. Some will, and will keep fresh looking for several days; others succumb to the treatment at once. Indeed, there are individual flowers which seem to resist and defy any process of preservation. Experiment is the best guide in discovering which these are.

A very successful method of preserving not only flowers but whole plants and shrubs, of the most difficult kind, was discovered and practiced some years ago in Germany, and was first made known in England and America through Selmar Schonland, of Oxford.

The flowers or plants to be preserved are put into water saturated with sulphuric acid, to which methylated alcohol (ordinary strength) is added, in the proportion of one part of alcohol to three of water. Plants with thick leaves are left in the fluid for a day, or a day and a half—according to their thickness; delicate flowers, vines, ferns, etc., from five minutes to half an hour—according to the texture of plant or flower.

The specimens are then removed and the fluid on their surface is left to evaporate by exposure to the sun or to artificial heat, and when evaporation is complete, the specimens are removed and placed between sheets of drying paper, in the usual way. As a rule it is not necessary to change the paper. Treated in this way plants retain from the first their natural color; or it sometimes happens that the color changes slightly at first, or even disappears altogether, and is regained in a short time. Flowers when submitted to this process lose scarcely any of their natural splendor. The most difficult part of the treatment in the case of delicate flowers and foliage, is the laying out of the parts on drying paper after treatment in the solution. This calls for care and patience.

This process is said to not only preserve color but also to hasten the drying of the plants. The thick stems of the *Euphorbia globosa* were found to dry completely in three days, the juicy and thick rosettes of species of *Echeveria crassula* and *Semper vivum* in two. The fleshy inflorescences of the *Arum* order dried in one day, and all kept their natural color completely, or nearly so. Plants, too, which usually turn black in drying, such as the Tooth Wart, and others, when treated in this way, kept their natural color. A solution, once made, can be used several times, so that the process is neither unduly troublesome nor expensive.

Another and older method is to dust powdered salicylic acid on plants, as they lie in the press, and remove it again with a brush when the flowers are dry. Red flowers in particular are well pre-

served by this agent. Flowers may be beneficially exposed to a solution of one part salicylic acid in fourteen parts alcohol, by means of blotting paper or cotton wool soaked in the liquid and placed above and below the flowers. Dr. Schouler long ago recommended, in the "Gardener's Chronicle," the use of sulphuric acid for preserving color, and suggested that in the case of delicate flowers, they might be placed loosely between sheets of vegetable parchment before immersion in the liquid, as this tended to preserve their natural form. If the stems of flowers be set in water in which twenty-five grains of sal ammoniac have been dissolved, they can be preserved for from fifteen to thirty days. To preserve them for several months, dip them in a perfectly liquid gum water and drain, as described earlier in this article, so that the gum may form a complete coating when dry. Any flower can be preserved for at least two weeks by putting a little saltpeter or carbonate of soda in the water in which it is left standing.

The Herbarium is *Hortus Siccus*—literally, a dry garden; and whether its range be small or large, it should be complete as far as it goes. Each plant introduced into it should have all its parts: flowers, buds, leaves, roots, seeds. In the case of certain plants being too large, branches from them, with some of the main roots, should be introduced in a way to give an idea of the complete plant. Wherever the roots are too thick they can be sliced, from the side which is to lie on the drying paper.

Before attempting a practical herbarium of one's own, it is a good plan to study the make-up of the best herbariums in your vicinity. In these days every town and village has one. One does not need to travel to the British Museum, or the famous Gardens of Kew, and see one hundred thousand species, and all the numerous specimens from these, in order to make up a very creditable home collection. But it is well to see how specimens are mounted by professional workers, and how the shelves and closets, in which specimens are laid, are arranged.

Always have on hand plenty of paper,—soft, unsized, bibulous paper, such as common newspapers are printed on,—or blotting paper. Experts have recommended the stitching together of a dozen or so sheets into a book called a dryer. Fold each specimen in a single sheet between driers, under as much weight as the specimen will bear without crushing it. Change the driers every day, or oftener, if necessary, for about a week. Some plants turn black in the drying. These are often dried by artificial heat, under pressure, before a fire or in a moderately heated oven, the process not lasting more than a few hours.

The paper on which specimens are fastened, after they are dried, is usually seventeen inches long and a foot wide. On each sheet



should be written, at the left-hand corner, the name of the specimen, the date on which it was collected, and any other information relating to it or its species. The specimen should be fastened with little slips of paper, touched with hot glue; or by a leaf or stem of the specimen itself. The lighter the fastening the better, provided it will hold. In order to keep away moths, an alcoholic solution of mercuric chloride, applied with a brush to specimens before they are mounted, has been found effective. And if they are afterward put away in layers in a closet, it is well to tie a piece of camphor in a muslin bag and hang this inside the closet. In putting away specimens, always write the name of the genus on the corner of the book in which the specimens are laid.

Experience is always the best teacher, and as individuality enters into everything that is done, each one's experience is apt to be a little different, and an observant worker always discovers little touches and side aids by which he can assist himself. But if references to authorities are required, consult, on general topics, De Candolle, Endlicher, Bentham and Hooker; for ferns, Hooker and Baker, and for mosses, Muller.

A mixture of gum arabic and gum tragacanth is recommended by some as preferable to ordinary glue for fastening specimens. To keep away insects and vermin from specimens, the following mixture has also been found effective: Liquid solution made from one quarter of a pound each of corrosive sublimate and carbolic acid, in one gallon of methylated spirits; brush this over the plants.

Some recommend very delicate plants to be mounted, like minute sea mosses, on glass, so that they may not be disturbed or broken in examining them, and, with the microscope they can be perfectly seen through the glass.

Always collect plants or flowers on a dry day. Morning is the best time for doing so. The fact that you, yourself, may enter into the occupation with more zest may be a matter worth considering; but the important thing is that the flowering plant is at its best in the morning. Flowers have awakened after a night's rest and are bright and alert, whereas if you wait until the afternoon you may discover them showing signs of an inclination for an afternoon nap. Half the inhabitants of wood or field show this tendency. Some of them half close their petals at noon, and you should not, by preference, pick them in this state. In order to have a good specimen, you should select the flower at its best and sacrifice the plant while in vigorous life.

Many lilies show a tendency to curl up in the afternoon. Of these may be mentioned the many-hued Iris family, the fringed Gentian, all

the *Convolvulus* family, wild Orchids and others. Even a slight observation of their habits will soon show which should be gathered in the morning and which may be left for afternoon. If gathered flowering plants cannot be prepared for the press immediately after reaching home, it is best to set those whose flowers droop most readily into water in which there has been thrown a crumb of saltpeter, or bicarbonate of soda, and leave them there until they are mounted. But never, if you can avoid it, wet the petal of the flower you are about to mount. It is always best to bring home with the plant a little of its own earth around the roots. This helps to keep it fresh.

In starting out to collect plants, it is not necessary to go heavily loaded. A trowel or tiny spade and a basket is all that is absolutely necessary. If the basket has straps so that it can be slung over the shoulders during a tramp through the woods, so much the better. In searching for early spring flowers, such as *hepatica*, *sanguinaria*, *anemone*, *saxifrage*, or later, *arbutus*, it is well to remember to go warmly clad and have the feet well protected. These delightful little flowers have a trick of hiding sometimes under patches of belated snow in Northern woods, and at any time court moist places. In summer these cool nooks wear a different face and are grateful to the tramping amateur botanist.

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In selecting specimens of ferns, it is our own delicate and varied wood ferns that are most desired by collectors. These are associated with the most beautiful portions of the world's surface, and make the most graceful of its garments. They love to grow in shady places and near running water, and in porous soil where their roots can have free play. They shoot out of fibrous, peaty land, or the spongy mold under trees whose fallen leaves feed them. Here you may look for growths both large and small, the rose-shaped sturdy-rooted varieties, as well as the filmy leaves of the *maidenhair* and *spleenwort*. A basket or box and a small spade or trowel form the equipment necessary for collecting ferns of ordinary size; for large growths, of course, a suitable vehicle is necessary for their transportation.

Those who have not tried the process are apt to think the preservation of ferns a much more difficult task than it really is. A gentleman who had spent years in the service of a great herbarium in Europe, told the writer recently that he found ferns one of the easiest plants to cure. "All it requires," he said, "is simple blotting paper—or even soft, common, brown paper will do—of proper size, smooth and unwrinkled, and lightness of touch on the part of the



operator. Lay your fern on the paper, smooth out every leaf and hair thread, bringing the veining into full view and keeping the frond heads intact. Be careful also to preserve the correct shape of the plant as it grows. When perfectly prepared, lay over it another sheet of paper, and cover with a press, according to the size and texture of the plant. For a very delicate fern, a weight of stiff paper is better than a board, and to keep this steady, bits of rock, or other light weights, can be laid on it. As the juice of the plant soaks in, the paper will become wet and discolored. It is only a matter of care and intelligence to lift and loosen the plant with the fingers, or a thin blade, if necessary, and to adjust the fresh paper underneath so that the fern may be gently slipped upon it. A few days will dry a fern. In fastening it on the paper on which it is to remain, use very little of the sticking liquid; a touch or two, the very slightest, on leaf or stem, is enough to make it adhere; the fewer the better, if you would keep the plant looking natural." Foreign ferns that have been naturalized and grown in pots, garden or greenhouse, may be cured in the same way as native ferns from the wood.

In searching for ferns, if you would procure variety, you must not confine yourself to one locality. There are differences, even in the same fern, when one is grown in the deep wood and the other around the root of a tree in the open. No instruction on the subject can teach like personal experience, and the collector who would have ferns in variety must seek them where they grow. One of the charms of collecting is the surprises you will come upon, and a beautiful fern found unexpectedly is of much more value to the finder than any number of labeled specimens.

## TREES AND FRUITS

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### THE MAPLE

#### *Acer*

THE Maple family comprises ten or more varieties, all of which are worthy of special mention. They are the handsomest of our shade trees, and among the most valuable for commercial purposes. They are rapid in growth, and when given sufficient space, extend their branches symmetrically in all directions. The foliage is remarkably beautiful, the leaves changing color with the seasons. In spring they are a light, delicate green, darkening as summer advances, and with the first frost of autumn assuming brilliant shades of red, yellow and orange. These leaves can be preserved in shape and color by dipping in warm white wax and pressing with a hot iron.

The shape of the leaf is broad at the base, dividing toward the top in three parts, which end in points. The edge of the leaf is notched at intervals. It has closely traced veins, which are darker in hue than the young leaf, but lighter than the older one, thus creating a noticeable contrast.

The Sugar Maple, known to botanists as *Acer Saccharinum*, is one of the most valuable trees in America. Its average height is from fifty to sixty feet, but, under favorable conditions, it frequently grows to seventy and eighty feet. In diameter it ranges from eighteen inches to four feet. It somewhat resembles the English oak in the formation of its trunk and the density of its foliage.

The flowers which appear on the Sugar Maple in April and May are small, of a pale greenish yellow, and are suspended by slender, drooping peduncles. This tree grows principally in the northern and middle states, but is found as far south as Georgia. It responds quickly to cultivation, and is prized not only for its fine wood, but for the delicious sugar and syrup made from the sap. Trees do not live long which are yearly deprived of their sap, for which reason people who follow the industry of sugar-making should add young trees frequently to take the place of those which die and are cut down and sold for timber and fuel. The life of the Sugar Maple depends largely upon the care and treatment given to the tree, that is yearly robbed of its lifeblood. The Black Maple is a variety of



the common Sugar Maple, with no distinguishing difference, except that the leaf is finely covered with down on the under side, and the bark is much darker in color.

The Silver or White Maple is most common along river banks, and is found from Maine to western Florida and in Dakota and the Indian Territory. It grows very tall, and has long spreading branches, which droop. The wood is white, soft and of little value. The Silver Maple receives its name from the appearance of its leaf, which is silvery white on the under side. The leaves are longer than those of the Sugar Maple.

## STRIPED MAPLE

### *Acer Pennsylvanicum*

THE *Acer Pennsylvanicum* derives its name of Striped Maple from its vertically striped bark. This bark is smooth, with light green and reddish gray or brown stripes, which distinguishes it from the other Maples. It is a small, slender tree, which, in some parts of the country, is looked upon as a shrub. In other portions, where it is cultivated and grafted, it grows more rapidly, and reaches a height of from thirty-five to forty feet. It is found throughout the country from Nova Scotia westward, and southward to Georgia and Tennessee. In the latter state it reaches its greatest size.

The branches of the Striped Maple are very slender and upright. The leaves are tooth-edged and fine; they are said to resemble the foot of a goose in shape, the outline widening toward the summit and dividing into three clear-cut lobes. The flowers are a bluish green, the buds appearing in May or June. The seeds have large, divergent, pale green wings and hang in long clusters.

The Striped Maple seems to be of a sensitive, shrinking nature, always striving in its wild state to hide under the shade of taller trees, whose large branches offer protection from the storms and the hot rays of the sun. In New England, this tree was frequently called the Moosewood, because in spring deer browsed on the young shoots.

The wood is of very little commercial value, the tree being prized merely for its ornamental beauty. In the autumn, the leaves of the Striped Maple are a bright yellow, which forms a pleasing contrast to the varieties of gorgeous red worn by its sister Maples.

## THE RED MAPLE

*Acer Rubrum*

THE *Acer Rubrum*, Red Flowered Maple, is very beautiful when it is in a state of cultivation, but has a shaggy appearance when uncared for. It has a wider range of growth than the Sugar Maple, which it somewhat resembles. It never attains the height of its sister tree, but, having an abundance of foliage, and being the first to blossom in the spring, it is a general favorite for shade. Its growth is rapid, and it is easily transplanted without injury. This tree was first cultivated in England by John Tradescant, Jr., in 1646, at South Lambeth, near Vauxhall. In America, its range extends from the Gulf of Mexico to the northern states; it thrives in the different climates and is evidently able to adapt itself to the cold and heat without affecting its nature. The flowers are of a beautiful deep red. These unfold about two weeks before the leaves. The leaves are smaller than those of the Sugar or Silver Maple but are similar in shape. They are darker in color, having a reddish tinge. The wood has but little strength and speedily decays when exposed to alternate moisture and dryness. It is used in carving, and for articles which do not require hard wood. As a fuel its value is small, owing to the quantity of its "heartwood."

## NORWAY MAPLE

*Platanoides*

THE Norway Maple, *Platanoides*, has been introduced into this country and is one of the handsomest Maples, highly cultivated as an ornamental shade tree. It is very desirable in large grounds, parks, driveways and along the avenues in small towns. It is similar in shape to the Sugar Maple, rounded in outline, with an abundance of brilliant foliage. This tree loves the sunshine, eagerly absorbing the summer rays through its broad, thin leaves, which are smooth and bright in color. In shape, they differ slightly from those of the other maples, having seven short lobes sharply serrated. The fruit hangs in clusters and forms a distinctive feature of the tree; the wings are frequently two inches long. Another feature which is found only in this member of the Maple family is the milky juice contained in the stem of the leaf. The commercial value of the Norway Maple is of very little account, the tree having established itself as a thing of beauty, as an ornament rather than as a useful wood to be hewn into timber.



## THE JAPANESE OR BLOOD-LEAVED MAPLE

*Japonicum Atropureum*

THE Japanese Maple is a dwarf tree which is extremely beautiful. Its foliage is red, varying from a light, almost pinkish, tinge to a deep crimson. Its flowers are small, the fruit smooth and the lobes of the leaves are obtuse. The tree is not well known in this country, as only a few specimens have been transplanted, but it is supposed to grow to a greater size and height in its native soil. It derives its name "Blood-leaved" Maple from the color of its foliage. It is valuable in landscape gardening as it forms a handsome background for other shrubs of a lighter, less pronounced color.

## THE ASH-LEAVED MAPLE

*Acer Negaundo*

THE Ash-leaved Maple, or Box Elder, is a handsome tree, possessing many striking characteristics of the Ash, the Elder and the Maple. The fruit belongs exclusively to the last, for which reason it has been classed with the Maple family. It is of rapid growth and is a favorite as an ornamental tree, but has very little commercial value, owing to its short life, and the fact that its wood is not strong. Inferior articles of furniture are, nevertheless, made from this wood, and small quantities of Maple sugar are obtained from the sap, but not enough to give the tree a name among the useful members of the Maple family.

It grows best in the southwestern portions of Vermont and Pennsylvania, and claims the distinction of having been one of the first North American trees that were known in the mother country. As a shade or ornamental tree, this Maple is unsurpassed, its early decay being the only drawback to its popularity. It grows to a height of fifty feet, but is more commonly found about twenty or thirty feet high.

The bark is a greenish brown, with a rough surface. The tree is widespreading, and has brilliant foliage. The leaves are long, with coarsely toothed edges; they are dark green on the upper side, light, with a yellowish tinge on the under, and are grouped on long slender stalks; the veins are very prominent. The flowers are a yellowish green; they are small and grow from the side of the branches in drooping clusters. These appear before the leaves in April or May.

## THE SYCAMORE TREE

*Acer Pseudo-platanus*

THE Great Maple, or Sycamore, is found in various parts of the world. It is one of the finest trees known, and is remarkable for its size and grandeur. It vies with the Oak and Ash in the beauty of its foliage, which is dense and symmetrical. The Sycamore is of rapid growth, and often reaches a height of eighty or one hundred feet. The bark, which is smooth and of a steel-gray color, peels off readily when the tree is old, giving it the appearance of being patched. The flowers are green and form into pendulous clusters. The fruit, or capsules, are smooth and have two or more diverging wings. The leaves are large, being from five to six inches broad with serrated lobes; they are beautifully graduated in color, the middle lobe being a delicate light-green, the lower ones very dark, almost brown.

There are several varieties of this fine tree, which, although bearing strong resemblances, have distinguishing marks. The White Variegated Leaf Maple has leaves covered with white spots. The foliage is handsome in the early spring but soon grows rusty and ragged.

The Yellow Sycamore has leaves of yellow and green.

The Purple Sycamore has leaves that are a rich, deep purple on the under side and are very beautiful when the wind blows, showing the contrasting colors of the upper and lower sides of the leaf.

The Subobtusa has broad blunt leaves. The Cut-leaved Sycamore is what the name suggests, a tree with leaves that are jagged.

Among tree emblems, the name Sycamore, *Acer pseudo-platanus*, signifies curiosity, because it is supposed to be the tree on which Zaccheus climbed to see our Saviour.

Cowper has said of this tree,—

“ . . . Nor unnoticed pass  
The Sycamore, capricious in attire;  
Now green, now tawny, and ere Autumn yet  
Has changed the woods, in scarlet honors bright.”

## MAGNOLIA

ALL species of the Magnolia are highly ornamental, some of them remarkable for majesty of form and magnificence of foliage.

The flowers are beautiful and fragrant.

The Magnolia may be cultivated in the southern and middle states of North America and the corresponding latitudes of Europe, without



protection, but in more northern regions the less hardy kinds are greenhouse plants. Many varieties have been produced by cultivation. The large-flowered Magnolia claims a place among the tallest trees of the forest. It varies in height from sixty to one hundred feet and from one to three feet in diameter. It grows straight, like a beautiful column, the head of which frequently forms a perfect cone. The roots branch out to a considerable distance. The bark of the Magnolia tree is smooth, resembling the beech in color and texture. It is very bitter to the taste. The leaves are from six to twelve inches long, and from three to four inches wide. They are smooth and shining on the upper sides, and their edges are straight and entire. The flowers produced are found on the ends of the last year's shoots. They are from six to ten inches in diameter, and almost overpoweringly sweet and fragrant.

The *Magnolia grandiflora* is indigenous to a tract of country extending from the lower part of North Carolina along the districts of the more southern states. It is said to grow in Texas near the Brazos. The bark of this tree was formerly prescribed in Florida, in combination with snakeroot, in the treatment of malaria and chills, or intermittent fevers. The wood is of very little use, either in the manufacturing world or as a fuel. It is soft and white and very heavy; when exposed to the alternations of dryness and moisture, it soon decays. The glaucous-leaved Magnolia is inferior in size and less regularly formed. It does not exceed forty feet in height, and has an extensive range. The blossoms are even more fragrant than those of the large-leaved Magnolia, the odor being heavy and insupportable when confined in a close apartment. The wood of this species of the Magnolia is sometimes used in making joiners' tools. The bark is distilled and used as a medicine. There is also some resin in the bark when in a dry state. The flowers are frequently dried and form the basis for potpourri, as a substitute for the perfume of the lily of the valley.

## THE GREAT-FLOWERED MAGNOLIA

### *Magnolia Fœtida*

THE Great-flowered Magnolia is, without exception, the most beautiful tree in America. It grows to a height of sixty to eighty feet in its native soil. Its flowers, which are from seven to twelve inches in diameter, are creamy white with yellow centers; they grow on the ends of the branches and are so fragrant that the odor can be detected before they are within range of the eye. The

Southern people are proud of the Magnolia tree, and at one time it was held in especial veneration by the inhabitants of Charleston, South Carolina, because under one of these trees General Lincoln held a council, with his officers, in 1780, as to the advisability of retreating before the British. The decision was against it, and in a few weeks the city was surrendered. This particular Magnolia spread its branches more than a hundred and fifty feet in all directions. It was considered one of the landmarks, until it fell into the hands of a man who esteemed it more for its commercial value as fuel, than for the pleasure it would bring him as a relic, and had it cut down.

The wood of this Magnolia tree is of more value than that of the other members of the family, but as yet very little use is made of it, excepting as an ornament and for fuel. The juice of the branches, which is bitter and aromatic, is used for a tonic.

## THE LAUREL MAGNOLIA TREE

### *Magnolia Glauca*

THE glaucous-leaved Magnolia, known as the White, or Sweet Bay tree, or Laurel Magnolia, is a small tree which does not attain a height of over twenty or thirty feet in its native Southern swamps, and in the North is considered more as of the shrub family. The trunk is usually distorted, unless carefully trained, and the large number of branches which begin at the very roots, are twisted and intertwined. The bark of the trunk is a light grayish brown, bitter to the taste and covered with thin close scales. The smaller branches are a bright green, which turn reddish-brown with age. The leaves are oval, lance-shaped, shiny, and dark green in color, on the upper side; the lower, being covered with a fine whitish down, makes a pleasing contrast. The leaves are smooth and thick. In the South the old leaves remain on the tree until the new ones form, but in the North they fall when the first frost gives warning that winter is approaching. The fruit is cone-like in shape, and contains two scarlet seeds, which, when ripe, are full and fleshy. When the seeds burst their cells they hang several days by white, slender threads. Small trees of this species are generally produced from seeds, but the Magnolia requires great care, as the seeds are easily destroyed. The flowers are from two to three inches in diameter, and are exquisitely beautiful and fragrant. When confined in a close room, the perfume is overpowering. The flowers are creamy white, with yellow stamens. They are considered among the choicest blossoms in their native climate, as well as



in the North, where they are tenderly cared for as hothouse shrubs, in winter.

The wood is soft and of little use in a commercial way, but is sometimes used in making joiners' tools and broom handles. The bark is used in compounding medicines for intermittent fevers and rheumatism. The flowers retain their odor when dried.

## THE HOLLY FAMILY

### *Aquifoliaceæ*

INSTANTLY at the mention of the Holly our thoughts turn to Christmas merry-makings. Everyone is familiar with the hard, thick, shining leaves and bright, red berries, without which no Christmas decoration is complete. Not less attractive is the tree as a whole. It is rare and always small in the Northern states, but throughout the South it is abundant, growing to a height of from thirty to fifty feet. It flourishes best in Southern Arkansas and Eastern Texas. It is a slender tree, tapering toward the top. The bark is light gray, covered with excrescences. The younger branches are first green, covered with a rusty coating of down. Later they become smooth and brown. The leaves are almost unique. They are peculiarly tough and warped, of a deep green, very glossy, and sometimes yellowish beneath. The edge is wavy, each projecting point being armed with a sharp tooth. These leaves cling to the tree for three years, for the Holly is an evergreen; at about the end of that time they are pushed off in the spring by new buds. The foliage of the European Holly is handsomer even than that of the American species, but it will not grow here except in the Southern states. In Virginia are several aged trees supposed to have been planted soon after the settlement of Jamestown, in 1607. The small, greenish-white blossoms do not appear until June. They grow from the axils of the young leaves, when the latter are about half grown, or along the bases of young branches. The round red berries, about the size of a pea, remain on the tree all winter.

The common species, just described as typical, is *Ilex opaca*. A species known as Mountain Holly, *Ilex monticola*, would not be recognized by a superficial observer as belonging to the family. Its leaves are deciduous; light green instead of dark; serrate, not wavy; tapering to a sharp point, and entirely without the sharp spines of the common Holly. The fruit, too, is much larger. It is found in the Catskill and Alleghany mountains. Species of the Holly are found in nearly every country in the world, one hundred and seventy-five in all having been recognized. The tree is a very slow grower, and lives to a great age.

## THE PINE

*Pinus*

MANY peculiarities combine to make this one of the most interesting of trees. Not the least is the fact that it is a remnant of the Carboniferous Age, a surviving member of a great family that helped to furnish our coal beds. With its relatives, the other coniferæ, it forms a class widely different, botanically as well as in general appearance, from the other forest trees. They are known as gymnosperms, or naked seeded plants. The flowers, scarcely worthy the name, even scientifically, are borne in aments or catkins. They consist of little more than two exposed ovules borne on a scale which nestles in the axil of another scale or bract. The ovule-bearing scale quickly outgrows the bract, which in the developed cone is lost to sight. It may be seen on breaking the cone apart. In the firs this bract remains conspicuous. The cone does not ripen until the second or third year after flowering. It varies considerably in form and size in different species.

The leaves of the Pine are of two kinds,—primary and secondary. The latter are those which we commonly know as “needles,” forming the foliage of the tree. In different species these vary in length and in form, some being perfectly round, some flattened or grooved. They spring in clusters from the axils of the primary leaves, which are usually mere scales, but occasionally take a linear form. All Pines are evergreens. In the spring the dainty, light green needles, coming out at the ends of the branches, form a striking contrast to the dark ones of longer growth.

The appearance of the tree itself is usually stately, although there are some dwarf species. The trunk is almost always tall, slender and tapering; the branches springing in umbel-like arrangement at intervals. From the resinous sap, which often exudes and trickles down the tree, are derived resin, pitch, tar, turpentine and many other similar valuable products.

Of the many species and varieties of Pine, we shall consider only those growing within the United States. Of these, perhaps none is of more importance than the Oregon Pine. This is a great tree, sometimes reaching to a height of three hundred feet. In Washington and Oregon, where for some reason it flourishes best, there are large forests of it. It is scattered northward to British Columbia, and southward as far as Mexico. Its wood, hard and durable, forms the most valuable timber of the Pacific region. Because of its great length and straightness, it is desirable for masts.



Another important Pine is the Georgia, or Long-leafed species (*Pinus palustris*). Vast forests of this are spread along the Atlantic and Gulf coasts, beginning at Virginia. This tree seems to love the salt water; it is seldom found more than one hundred and fifty miles inland. It grows to a height of from seventy to one hundred and twenty feet, and is sometimes three feet in diameter. It is a tree of great dignity and beauty, with long, flexible leaves measuring nearly a foot in length, and handsome cones. The wood of this species, commonly called Yellow Pine, is very valuable commercially, its uses being mentioned elsewhere. The Giant, or Sugar Pine (*Pinus lambertiana*), found on the Pacific coast, yields a sweet sap which is sometimes used for sugar.

The Pitch Pine (*Pinus rigida*), is well known throughout the Atlantic states. As its Latin name would suggest, it is a stiff tree, scraggly yet not by any means ugly. It is prominent among the Pines of New Jersey and Long Island. It is a rapid grower, and can live in soil too poor for most trees. When cut down, shoots quickly spring from the roots and flourish. In this it is an exception to the rule of its kind. Among the Greeks, the Pine was the emblem of death because it did not spring up as other trees after cutting down. The timber is of little value, but it is rich in valuable resinous sap.

The Jersey, or Scrub Pine (*Pinus Virginiana*) is a small, ragged tree, which, nevertheless, helps to beautify the landscape by spreading itself over worn-out fields. Unlike nearly all other Pines, its branches are smooth, not scaly. It is of little commercial value.

The Canadian, or Red Pine (*Pinus resinosa*) extends into the northern part of the United States. The reddish-brown bark and red wood have given it one of its names, but why it should be called *resinosa* is not so clear, as many other Pines contain a greater abundance of resin. The Red Pine is especially beautiful while young. Its long, flexible needles grow in graceful clusters along the sides at the tips of the branches. As the tree ages these side clusters fall away.

## SPRUCE FAMILY

### *The White Spruces — Picea Alba — Picea Canadensis*

THIS variety of the Spruce or Fir family is a native of cold climates in the temperate zone. It is found abundant in Newfoundland, the Hudson Bay region, and Alaska, and southward to Maine, New York and Michigan. Its westward range is to South Dakota, Montana and British Columbia. It is a slender, conical tree, usually sixty to seventy feet high, but sometimes reaching one hun-

dred and fifty feet. Its foliage is spirally inclined, as is its whole outline; the narrow, spiral leaves crowd on the upper part of the branches by the twisting of those beneath, and point sharply forward to the extremity of the branchlets. At first they are a pale, bluish green, semi-hoary in effect, then become a dark-green bristling mass, three-fourths of an inch long. The leaves of the Spruce differ from those of the Pine in that they are much shorter and are placed singly on the branches, instead of being clustered together in close groups, like those of the Pine. When dry, they fall and leave bare twigs covered with rough projections.

The White Spruce sometimes reaches one hundred and fifty feet, with a trunk measuring three feet around. Although the foliage is beautiful in its prime, the odor of this tree is unpleasant; and this alone may serve to distinguish it from the Black Spruce, whose resinous gum is pleasant to smell and taste. The gum of this tree is white and soft. It flowers in April and May. The cones are also different from the Black Spruce, being of a lengthened oval form, about two inches long. The seeds are also smaller and ripen earlier.

The wood is light yellow, soft and weak, with straight-grained, satiny surface. It is used in making the cheaper grades of furniture, for interior finish of houses, and for wood pulp. When burned, it snaps more than the Black Spruce. The tree that has sometimes been designated Blue Spruce is practically the same tree as the White Spruce, both names coming from the bluish-white shadings of the foliage when young. Woodsmen have also called it Single Spruce, to distinguish it from the Black or Double Spruce.

#### *Black Spruce—Picea Nigra*

THIS evergreen is also of pyramidal outline, and distributes itself over much the same region as the White Spruce, but grows well in somewhat colder latitudes. It is very abundant in Lower Canada, Newfoundland, New Brunswick, Nova Scotia and Maine, also in Vermont and the upper part of New Hampshire. Farther south it is not seen at its best, except in cold and humid situations on the top of the Alleghanies and the mountains of the Carolinas. It is found in Michigan, Wisconsin and Minnesota. The finest forests of it are found where the soil is black and covered with mossy beds. The branches are pendulous, rather slender, with an upward curve, the roots thick, widespreading and the rootlets long, flexible and tough.

The bark is grayish-brown, scaly when old, and has no commercial value. The leaves are spiral, thick, and spread in all directions, and are of lustrous green. The cones are somewhat thicker and shorter than those of the White Spruce.



The tree does not retain its beauty after youth, and in old age sometimes becomes misshapen and unsightly. It derives its name from the dark green of its foliage, which, when massed on a mountain side, produces very sombre shadows. The cones of the Black Spruce cling to the tree during flowering time, and even persist in clinging to it sometimes for years; while the cones of the White Spruce fall off during flowering time. Resin flows freely from cuts or wounds in the tree, and thus hardens into the chewing gum that has so long been a marketable commodity. The odor from leaves and bark is pleasant and aromatic.

A favorite drink called spruce beer is made from boiling the young branches of this tree and adding to the liquid, molasses and yeast in certain proportions. This drink is not now so popular as of yore, but it played a prominent part in entertainments among the early settlers, and Cooper has immortalized it in his "Leather Stocking Tales." The wood of the Black Spruce has had a great maritime history; for generations it was manufactured into masts and knees for vessels built in Massachusetts and Maine. It is now used most largely in housebuilding, for the sounding-boards of pianos, for pulp and for fuel; and it is still one of the chief articles of commerce in the extreme West. In the East and North the oldest trees have been largely cut down. In the soil it loves, it grows to a great height. The distinguishing properties of its wood are strength, lightness and elasticity.

*Red Spruce — Picea Rubens*

THE Red Spruce grows best from Nova Scotia to North Carolina and Tennessee. It reaches one hundred feet or more, but its common height is from seventy to eighty feet. It grows slowly and has thick resinous roots. The Red Spruce was for many years confounded with the Black Spruce; but Professor Sargent has shown wide distinctions between the two. The cones of the Red Spruce are large and fall during the first winter; while those of the Black Spruce remain on the tree for years. The Black Spruce is a tree of the far North, having but a precarious existence south of the very northern borders of the United States. The Red Spruce, on the contrary, is an Appalachian tree, and attains its greatest size in northern New Hampshire and Pennsylvania. Spruce beer is also made from this tree; and from it is obtained the pinkish chewing gum of commerce. It flowers in April and May. The anthers have bright red crests; the flowers are oblong and greenish. The wood is converted to the same uses as that of the Black Spruce.

## WHITE ASH

*Fraxinus Americana*

THIS is one of the most interesting of American trees, by reason of its rapid growth and its beautiful foliage. The common name refers to the silvery-white surface of the under leaf. This tree sometimes grows to a height of eighty feet, the trunk retaining its distinct central shaft after the division into branches, though when these are covered with the dense foliage, it is hidden from sight. The easy sway of its branches, with the somewhat drooping leaves, gives it a very pleasing appearance.

The bark is deeply furrowed, the ridges crossing each other in diamond shape. The branches spread from the central stem, diminishing in length as they proceed upward, with a regularity that gives the tree a beautiful form. The buds are large and broad, of a pale brown color, differing in this respect from those of the European species, which are short and often black. The leaves are from twelve to fourteen inches long, and composed of three or four pairs of leaflets, smooth and of a light green.

This variety of the Ash is native to North America, from Labrador to the Carolinas, and a cold climate seems more congenial to it than a milder one, as it flourishes abundantly north of the Hudson River. The White Ash was introduced into England in 1723, by Mark Catesby, and several large plantations of it were started in different parts of that country, in 1826. The wood of the Ash is light, strong and elastic, and was used by the Indians for making bows and paddles. Two ancient traditions of the Ash are that no serpent will go near it and that it is more liable to be struck by lightning than other trees.

## BLACK ASH

*Fraxinus Nigra — Fraxinus Sambucifolia*

THE Black Ash is of slower growth and not as long-lived as some of its sisters. It is the most slender of the forest trees; when growing to a height of sixty or more feet, its diameter will be scarcely more than a foot. Its bark is dark and tinged with gray. It seems to love cold, growing in damp swamps, and putting out its blue-black buds as early as March. It grows farther north than any other of the Ashes, ranging from Newfoundland west, and south to Florida and Arkansas. It does not endure transplanting well, nor will it grow in dry soil.



The wood is of a light brown and has a beautiful grain that shows well under a polish, making it useful in cabinet work; it is also tough and pliable and is valuable for many purposes. The Indians used the young saplings, preferring them to any other wood for making baskets.

## RED ASH

*Fraxinus Pennsylvanica — Fraxinus Pubescens*

**B**OTH the Red and the Green Ash, like the Black, prefer rich, moist soil, such as the banks of streams, but, unlike the latter, will grow where it is dryer. The Red Ash strongly resembles the White in general appearance, but the Red is downy on its branches and leaves, whereas the White is generally smooth. This down is of a reddish hue, and the inner surface of the outer bark of the branches is of a red or cinnamon color. This is also true of the White Ash.

The Red Ash is a rather small tree, averaging only about forty feet in height; the branches are short and upright, and its head is irregular. Its dry, wing-like fruit, similar to that of the White Ash but more spatulate, remains on the branches throughout the winter. The wood is light brown, brittle instead of elastic, and not as valuable, commercially, as that of the White Ash.

## BLUE ASH

*Fraxinus Quadrangulata*

**T**HIS is a native of the Mississippi Valley. It does not grow abundantly in any locality, but prefers a limestone soil. It extends from southern Michigan to central Missouri, and south to eastern Tennessee and northern Alabama, and through Iowa. It grows very tall, sometimes attaining a height of one hundred and twenty feet, and its trunk is occasionally two or three feet in diameter, though usually smaller.

Its distinguishing feature is its quadrangular shaped branchlets. It thrives in fertile bottom lands. It is hardy and grows rapidly, and its rich, shining foliage, free from insects, makes it well adapted for cultivation. The wood is dark yellowish and has much the same qualities as the other Ashes; it is used for flooring and for some parts of carriages. A blue dye is made from the inner bark and it is from this that it gets its name.

## GREEN ASH

*Fraxinus Lanceolata*

THE Green Ash very closely resembles the Red Ash; the flowers are nearly alike, and from other points of resemblance it is believed by some to be a variety of the Red Ash. It has darker and more lustrous foliage, and its leaves are shorter and narrower, and smooth, and both upper and under surface are a light green and always shiny. In New England the difference is more strongly marked than in the West, where they seem almost identical. The Green Ash is the most beautiful of all Ashes for ornament, and it easily adapts itself to new surroundings, though liking plenty of sunlight.

It is suitable for planting in cities, and for shelter, because of its ability to flourish where the rainfall is small or uncertain.

The wood is not as valuable commercially as some of the other Ashes, though it is sometimes substituted for the White Ash.

## THE INDIAN BEAN

*Catalpa*

THE Indian Bean (*Catalpa bignonioides*) or, as it is also called, the Southern Catalpa, is a native of the United States, throughout which it is common in cultivation as an ornamental tree. It has large heart-shaped leaves, downy underneath and, when young, from six to twelve inches long. The flowers are white, spotted with yellow and purple, and give forth a delicate fragrance. The tree grows to a height of from twenty to forty feet; its spreading branches support flowers in thick clusters, and it makes a pleasant and refreshing background for house or garden. In the southern states it is found wild, but in the North, where it is not indigenous, it is successfully cultivated and flourishes as far north as mid New York. The wood is soft and light and is principally used for railroad ties. It is popularly supposed that the honey secured by bees from the Indian Bean flower has poisonous properties. Sometimes the Catalpa is called the cigar tree, and the bean is even now surreptitiously smoked by reckless small boys. The first Catalpa planted in New England still stands on Washington Street, Hartford.

The Western Catalpa (*Catalpa speciosa*) is a much larger species, being almost twice as tall as the Indian Bean. Its flowers are long and white, faintly spotted, and the seed pod is thick and coarse. It grows wild in the low rich woodlands of southern Indiana and in the country lying immediately to the south and west of that state.



## WHITE THORN

*Cratægus Coccinea*

THE Rose family, of which the White Thorn is a member, is a very large one, said to include more than sixty species of thorn-bearing plants. The genus Thorn belongs to the same division of the family as the Apple, Pear, etc., the structure of the fruit being the chief point of difference, but both in cultivation and in its wild state the species are disposed to vary.

The White Thorn is a small tree, growing from ten to twenty feet in height, with spreading, crooked branches, and silver-green, glimmering branchlets. Its stout thorns are one or two inches long and are curved. The leaves alternate, are simple, often lobed, dark green, tinged with red. The abundant flowers, though smaller, closely resemble in structure those of the apple; they grow in clusters, and are generally white, though sometimes a delicate rose color, and have an unpleasant odor. The blossom keeps company with the dogwoods in early spring. The fruit of this variety is a bright scarlet, and on this account, is sometimes called Scarlet-fruited Thorn. The fruit remains on the branches until late in autumn.

## COCKSPUR THORN

*Cratægus Crus-galli*

THIS is one of the finest of the dozen varieties of Thorn native to the United States; it is found from Canada to Florida, and west of the Mississippi. In its wild state it produces varieties differing much in foliage. When well-developed by cultivation, it frequently reaches a height of twenty or more feet. There are also some garden varieties, one of which is a remarkable dwarf, much used as a hedge plant, for which its thick, compact habit of growth renders it especially well fitted. It is a conspicuous tree or shrub throughout the year, with its numerous, fragrant white flowers bursting into bloom in June, its thick leaves, dark green and shining in summer and turning to scarlet or dull orange in autumn, and its red fruit somewhat similar to the crab-apple, untouched by the birds, and remaining on the branches during the winter. It has numerous straight, slender, smooth thorns, from two to four inches long.

The wood of the Cockspur Thorn is close-grained and takes a fine polish, but, on account of its small size, its usefulness is limited. It is used in making handles of small tools where toughness is required.

## SCARLET HAW HAWTHORN

*Cratægus Mollis*

THIS is the most beautiful of the American thorns. It is a small tree with straight trunk and is very ornamental as a lawn tree, as it may be grown in a close pyramid, with its branches nearly touching the ground. It blossoms abundantly and insects do not attack its foliage. Its roots are fibrous; it grows wild along the margins of swamps, on river banks, or in rich prairie soil. This species has been confounded with *Cratægus coccinea*, but it differs in having larger and broader leaves, less deeply cut, and fruit that is large and edible—the only Haws that can really be called so, for though slightly acid, the yellow flesh has an agreeable taste.

It blossoms in May. The flowers are white and perfect; an inch or more across and grow in stout, broad clusters. The fruit is a light scarlet with a slight bloom.

## ENGLISH HAWTHORN

*Cratægus Oxyacantha*

THIS thorn tree, native to Europe, does not flourish as well in America as do some others of the species. It is a small tree or shrub, fine for the lawn, and is used largely in England for hedges.

The leaves are smooth, wedge-shaped at the base, and are lobed and toothed above the middle. The flowers are of medium size, single or double, white, rose color, or pinkish, and grow in numerous corymbs. It blossoms in common with most of the Hawthorns in May, the time when

“ . . . every shepherd tells his tale  
Under the Hawthorn in the dale.”

The fruit is a coral red, and is about one-third of an inch across. Though said to be edible, the fruit of the Hawthorn is not alluring to either bird or human; the proportion of seed to flesh making it undesirable as food. The wood of all the Thorn family is hard and strong.



## DOTTED-FRUITED THORN

*Cratægus Punctata*

THIS species of Thorn is found in New England, west and south to Georgia, and is particularly abundant in Virginia and Carolina. It is a compact tree, growing from twelve to thirty feet high, exceedingly effective as an ornamental tree, and when cultivated grows in a quaint fashion, broad and flat.

The bark is a reddish brown, the thorns light brown, sharp, sometimes three inches long. The foliage is smaller than some of the other species, the leaves wedge-shaped at base, tapering above, slightly pointed at apex and unevenly serrate, thick, light green and downy; when young, gray green, and at maturity, dull. It blossoms in May and June; the flowers are white, from eight to fifteen usually growing in a leafy corymb. The fruit is a drupe-like pome with bony seeds, round or slightly elongated, a dull red or yellow, marked with many white spots. In autumn the leaves turn to bright orange, or orange and scarlet.

## BLACK THORN

*Cratægus Tomentosa*

THE Black Thorn, also called Pear Thorn, from its pear-shaped fruit, is variable in its habit, producing several varieties, sometimes growing to a height of twenty-five feet, and again appearing as a shrub. Whether this variableness is simply an adaptation to different soils and climates is uncertain, but it is found in more localities than are any other of the American Thorns. One of the varieties has leaves dotted with white.

The bark is ashy gray in color, broken into thin scales; the young twigs are a bronze green, later becoming a dark orange, and finally an ashy gray. The leaves are simple, apex pointed, unevenly toothed, the upper surface a grayish green. The white flowers are abundant, grow in clusters at the ends of the branches, and have a disagreeable odor. The tree blooms in May; the fruit ripens in October. The thorns are stout, from one to two inches long. The bright scarlet or orange fruit, nearly an inch in diameter, remains on the branches all winter, and may still be seen when the flower buds begin to unfold in spring.

## THE LINDEN OR LIME

*Tilia*

THE Linden or Basswood is well known as a favorite ornamental shade tree. It is frequently and effectively grown along the streets of towns and cities, as well as on lawns. "Unter-den-Linden," in Berlin, is famed as one of the most beautiful streets of the world; and not the least part of its beauty is due to the trees from which it takes its name. There are several varieties, differing but slightly. Their general appearance is graceful and pleasing. Although these trees sometimes attain a height of one hundred and twenty feet, they are oftener from about sixty to eighty feet high; well-rounded below, but tapering somewhat toward the top. The trunk is usually straight, with dark brown bark, conspicuous for its deep, vertical ridges. Lindens sometimes attain a great diameter. The famous tree from which Neustadt in Württemberg took its name, "Neuberg-an-der-grossen Linden," measured nine feet across at the base.

The branches, starting at no great distance from the ground, light gray or brown near the trunk, are decidedly green at the end, which produces a pleasing effect. The leaves are handsome. They are dark green, smooth, and glossy above, but grayish and downy beneath. They vary in different species from two or three inches to seven inches in length, with a width nearly as great. The sides are rounded into almost a semicircle, irregularly toothed, and ending rather abruptly in a sharp point. Prominent veining also helps to give them character. Long bracts of a much lighter green show prominently among the leaves, giving the tree a variegated appearance. The dainty little cream-colored flowers spring curiously from the center of the midrib of these apple-green, leaf-like bracts. They look like little stars, the five slender petals standing out separately and being set off by a cluster of many stamens in the center. The five sepals are downy. These flowers are fragrant as well as pretty.

Because of the abundance and delicious flavor of the nectar secreted, the best of honey is said to come from apiaries situated near a Linden grove. The amount of honey produced by bees so situated is astonishing. "Bee-trée" is one of the names given to the Linden, and the celebrated Lithuanian honey is made from the nectar of this tree. Not less interesting is the tree when the little, hard, rough, ball-like fruits have replaced the flower-clusters. These are of a greenish gray, about the size of a small pea or an ordinary bullet. The children love to put pins through them, to make them dance at the end of a



pipestem, by inserting the pin into this, and then blowing into the other end of the pipe. These little balls nod on the trees for a long time before falling.

The American Linden, also called Basswood, Whitewood, and Whistle-wood (*Tilia Americana*), is widespread throughout North America, as far south as Virginia. It sometimes obtains the maximum height given above. The leaves are from four to five inches long. In the flower of this species are little petal-like bracts surrounding the stamens at their base. These are lacking in the European species.

The European Linden (*Tilia Europæa*) is distinguished from the American Linden by its blossom, as stated above; there are also several superficial differences in the general appearance of the trees. The European species is considerably smaller, seldom attaining a height greater than thirty-five or forty feet. It is also more slender, not so rounded in growth. The branches are lighter and higher from the ground, and the leaves are not so large. These trees are often planted about country houses.

The Downy Linden (*Tilia pubescens*) is more like the European Linden just described. It grows to about the same height, is slender and small-leaved. The bracts bearing the blossoms are sessile, and rounded at the base, instead of pointed, as in the other species. Much of the pubescence disappears when the tree reaches its full growth. The Downy Linden is common throughout the United States, south and west of New York.

And now we come to perhaps the handsomest of all the Lindens, namely, the so-called White Basswood (*Tilia Heterophylla*). This tree, which is found plentifully in the mountains of Pennsylvania, and through the South and Southwest as far as Tennessee, is usually about fifty or sixty feet high. The leaves are even larger than those of the American Linden, sometimes measuring seven inches. They are of a dark, rich green above, smooth and shining; below they are silvery and of velvety softness, with purple veins showing through. A certain irregularity, or lop-sided appearance, in the leaf, common to all Lindens, is particularly noticeable in this species. It is found in the southern states, and as far west as Illinois. Unfortunately, it is not often seen in the North, even in cultivation.

The wood of the Linden is light, close-grained, and will not warp easily. That of the American Linden is soft and brownish red in color; in other species it is white. It is used largely for toys and other small objects, turned or carved; also for the sounding boards of pianos, for the seats of chairs, and for many other purposes where a non-warping wood is required. The reddish wood of the American Linden is principally in demand for carriage panels, because it is

particularly free from blemishes, but it cracks easily in the working. The inner bark, or "bast," is as valuable as the wood. It was used by the ancients for the making of paper, mats, and twine. Bast mats are now made in Russia and exported.

## THE PECAN

*Carya Olivæformis* also known as *Hicoria Pecan*

THE Pecan, *Carya olivæformis*, or *Hicoria pccan*—for it rejoices in two botanical names—is one of the Hickories. Its habitat is in rich, moist soil, especially along the banks of streams, in the middle-west. It flourishes from Indiana and Illinois southward to the Gulf, and southwest, especially in Arkansas and the Indian Territory. It is a large, handsome tree, the largest of the Hickories, sometimes reaching a height of one hundred and seventy feet, with a diameter of six feet or more. In common with other Hickories, it has a rough bark and compound leaves of from nine to fifteen slender, sharply pointed leaflets. The young twigs are downy. The flowers are borne in aments, usually in the axils of leaf-scars on last year's twigs, sometimes in those of this year's leaves. One of the four lobes of the calyx—there is no corolla—is long and linear, the other three short and broad. The fruit, well known as the Pecan nut, is olive shaped, hence its name *Olivæformis*. It is encased in a thin, four-valved husk, which often splits open, allowing the nut to fall out, itself remaining on the branch all winter. The inner shell is hard and smooth, but thin. The kernel, unlike that of the hickory nut, is divided but once, and that by a thin membrane. This cell-wall is very bitter and astringent, but the kernel is sweet, oily, and delicious. The nuts ripen in September and October. They are well known as nuts of commerce. The wood of this tree is of little value.

## THE HORNBEAM

*Carpinus*

THE Hornbeam (*Carpinus Caroliniana*), also called the Blue or Water Beech, belongs to the Oak family. It is to be found from New England to Minnesota, growing principally along the banks of streams. It can be distinguished from the Hop Hornbeam by its three-pointed leaflets, placed in pairs, base to base, with the small nuts. The leaves are ovate-oblong, pointed, fuzzy when young, but growing smooth. The fruit is about three-fourths of an inch long,



the nut being about one-eighth of an inch. The tree, which is really little more than a tall shrub, grows to a height of from ten to twenty feet. It has a close, smooth bark, like that of the beech. The wood is white and hard.

## THE POPLAR TREE

### *The Aspen or White Poplar — Populus Tremuloides*

THE Poplar is a tree of wide range; it grows naturally in both temperate and arctic regions, forming extensive forests in the extreme North. Nine species are found in the United States; five of these are native to the eastern part of the continent, the others are indigenous to the Rocky Mountain region. Besides the native growths, three European varieties have been naturalized here, viz., the White (*P. alba*), the Lombardy (*P. Italica*), and the Black, (*P. nigra*).

The Aspen takes naturally to moist, sandy soil and gravelly hill-sides. It is small and slender, but occasionally reaches fifty feet in height, though generally it is not so tall, except in northern Arizona, where it grows one hundred feet in height, at an elevation of eight thousand feet above the sea. It grows rapidly, forming a narrow, round-topped head. The base is slightly heart-shaped; the roots are large and vigorous. On old trees, the bark near the base is nearly black; higher up, on the younger stems, it is a pale greenish or yellowish brown, running sometimes to whitish, and roughened with horizontal bars or wart-like excrescences or scars.

The branchlets, at first reddish brown and shining, change first to a light gray, afterward to a dark gray. In the early spring, the sweet inner bark is used as food by the Indians of the North. The leaves are alternate, simple, and one to two inches long. They are feather-veined, with the midrib conspicuous, and they come out of the bud a smooth light green; when full-grown they are dark green, shining above, a pale, dull, yellow green beneath. In autumn, they turn a bright yellow.

The inner buds are slightly resinous, reddish brown, conical, acute, incurved, and a quarter of an inch long. The Aspen flowers in April. The fruit is borne in oblong capsules, and the seeds within are light brown, surrounded with long, soft, snowy white hairs. It ripens in June. The entire Poplar family is the most restless of the forest inhabitants. The quivering of their leaves is owing to the compressed, pinched formation of their leaf stalks. Of course, fable and superstition have busied themselves weaving stories to account

for this peculiarity. According to an old tradition, the wood of this tree was taken for the Saviour's cross, and ever since, the tree has shuddered. Another old tradition says that when Christ went on his way to Calvary all the trees sympathized and mourned, except the Aspen; when he died, there fell upon the Aspen such remorse that it took on a fearful trembling, which has never since passed away.

The Aspen is very useful in forming an undergrowth that shelters longer-lived trees, and in late years it has spread over vast areas of the slopes of the Rocky Mountains, from which fire had swept the older native growths. The wood is light brown, close-grained, and is now largely used for flooring and for turnery. It burns freely, even when green. It has been little esteemed for cabinet work on account of its softness.

The Aspen is very tough and closes its wounds rapidly if hurt. Owing to this toughness it cannot be easily pierced or splintered by a blow; hence the ancients used it for bucklers, believing it invulnerable. It has been proved durable when not exposed to changes of atmosphere or to water. An ancient plank of Aspen was once found on which was cut this couplet:

"Though heart of oak be ne'er so stout,  
Keep me dry and I'll see him out."

*Large-toothed Aspen — Populus Grandidentata*

THIS tree is common in the north, but rare in the south, of the North American Continent. It loves a rich, moist, sandy soil, near the borders of streams, where it reaches a height of sixty feet. Slender, spreading branches spring from a trunk two feet in diameter, forming a narrow, round-topped head. Its sounding Latin title, *Grandidentata*, means simply that the teeth of the leaf margin are a little larger than those of the quivering Aspen described above. This species also flowers in April. It is gregarious and loves to form thickets of its own species. It looks very attractive as its leaves twinkle on the gravelly hillside, or hang over river banks; and as its leaves unfold around its long, drooping catkins, in May, it proclaims itself a Poplar, from whatever distance seen.

The wood of this species is also light brown,—the sapwood nearly white—soft, close-grained, but not strong. It is used sometimes for woodenware, but more largely for wood pulp, in paper manufacture.

*Swamp Cotton — Populus Heterophylla*

THIS member of the family is also called Downy-leaved Poplar. It is very rare in New England, but is seen occasionally on Long



Island and southward to Georgia, becoming abundant in the Gulf states, the Lower Mississippi Valley and northward to southern Illinois and Indiana. It loves low, rich land. It averages from sixty to eighty feet in height and never exceeds ninety.

The wood is dull brown, with lighter brown sapwood; it is of light weight, soft and close grained. It is used in the interior finish of buildings, and is manufactured into lumber for this purpose in the South and West.

The flowering catkins of Swamp Cotton are very graceful; broad, densely flowered, erect at first but finally pendulous; two to two and a-half inches long, with stout, brittle, hairy stems. The leaves of this Poplar flutter less than those of the other members of the family, owing to the leaf stems not being so much compressed laterally. The leaf retains its down more fully than any of the others, owing to which it is often called the Downy Poplar. In the Southwest, the wood is used largely for manufacturing purposes, and is called Black Poplar. It is darker than the wood of the Aspen.

#### *Cottonwood Poplar*

ANOTHER variety is the Cottonwood Poplar, called also *Populus Monilifera* and *Populus Angulata*, and in common speech Necklace Poplar and River Poplar. *Monilifera* refers to the necklace-like catkins, *Angulata* to the angular stem of the shoots—all big names for little differences.

Comparatively rare in the eastern states, and small when found there, this variety of the Cottonwood forms the largest and most abundant tree along the streams between the Appalachian and the Rocky Mountains. In these regions it reaches a height of one hundred feet. The leaf is egg shaped, with outline approaching the triangular; long, tapering apex, and square, somewhat hollow base. The leaf stem is long, slender and much compressed sidewise. Full grown leaves are from two to four inches long (young leaves much longer), the width nearly the same. The buds and leaves are balsamic in fragrance. The seeds are covered with a white, cotton-like fiber. The flowers come in March and April before the leaves. The trunk is light granite-gray and roughens and furrows with age.

The wood is brown, light, soft, close-grained, but not strong. It is now used mostly in making paper pulp, packing cases and for fuel. Under the name of Carolina Poplar, this tree has been much planted in cities and parks. It makes an excellent shade tree. Professor Charles S. Sargent says, "With its massive, pale green stem, its great, spreading limbs, and broad head of pendulous branches covered with

fluttering leaves of the most brilliant green, *Populus Deltoides* is one of the most stately and beautiful inhabitants of eastern America." Experiments have been made in weaving the cotton fiber of these trees into cloth, but it has not been found a paying industry.

*Balsam Poplar — Populus Balsamifera*

THE Balsam Poplar is also known as the Tacmahack. It is found in the far North, in New England, central Michigan and other western sections. In New England and the middle states it usually reaches a height of about sixty feet, but in the valley of the Mackenzie River, in Canada, it grows one hundred feet high, with a trunk six or seven feet in diameter. It prefers the bottom lands of rivers and the borders of swamps.

The leaf is egg shaped in outline, with taper pointed apex and rounded base. The buds in spring are large and yellow and covered with a fragrant gum. The leaf stem is nearly smooth, the lower half rounded, the upper part only slightly flattened. The leaves are simple, alternate, finely edged, rather sharply toothed, and from four to six inches long. This tree blooms in March and April, before it leaves.

This is the largest tree in extreme northern America. It possesses all the Poplar characteristics of drooping catkins, whitish trunk, shimmering leaves and cotton seeds. Its wood is light brown, of light weight, close grained in texture, but not strong. It is used extensively in the manufacture of paper and for fuel.

The other variety of this species is the *Balsamifera Candicans* or Balm of Gilead. It grows abundantly in the northern United States and in Canada, where it has been much cultivated as a shade tree. The leaves are simple, alternate and edge toothed. The leaf buds in spring are large, varnished and very fragrant. The leaves are from four to six inches long and nearly as broad. When young they are yellow, but with maturity, turn to a dark, rich green above, and whitish underneath. The bark is smooth, greenish and often dark spotted. The whole outline of the tree is egg shaped, tapering to a point above. It is a handsome tree, growing to a height of sixty or seventy feet, even on poor soil. It is deemed very desirable on account of its fragrance in spring, although there are people who do not like its odor.

*White Poplar — Populus Alba*

THIS Poplar, which is now found in most of the older settlements of this country, is not a native of our forests. It came in with the colonists by way of New England, and is believed to have



reached England itself through Holland. It is a native of both Europe and Asia. In favorable situations, it has been known to reach from eighty to one hundred feet, with sturdy trunk and spreading head.

Its leaf outline is a broad oval, approaching diamond shape, with pointed base. The leaves are usually about two inches long, and width about the same; the leaf stem flattened sidewise. Its branches are crowded and perpendicular. Low on the trunk the bark is dark and furrowed, above and on the branches it is greenish gray, with dark markings. The young shoots are covered with a white down, which continues to come out far into the summer, increasing the white aspect of the trees. The leaves are coarsely and sparingly toothed, dark green and smooth above and covered with a thick down beneath.

*The Lombardy Poplar—Populus Nigra Italica*

THIS is the last of the Poplars of which we shall speak. It is botanically called *Dilatata Nigra*. It is not a native of our country, but was introduced from Italy more than a hundred years ago and rapidly took to the soil. It is more scarce now than formerly, when its tall form, rising like a church spire, formed a landmark on many a hillside in New England and the middle states. In the latter, and in many parts of Massachusetts, it still flourishes, but the climate of New Hampshire and Maine has often proved too severe. In some localities it may be noticed standing in gray and withered nakedness like a sentinel frozen at his post. Nor is it the climate alone that does battle with it. Unfortunately, it is one of the trees on which insects love to feast, and if left unattended they often succeed in killing it; so that between climate in some quarters and insects in others, this distinguished looking tree is more rare now than it was two generations ago. It, however, continues to flourish where care is bestowed on it. The Lombardy Poplar grows very tall—eighty feet and upward—with oval base and very pointed top. The bark is roughish, the branches growing close together and upright. The leaves are simple, alternate, with leaf stems fastened sidewise; the color, a deep, clear green. Its flowers grow in catkins resembling in shape those of the White Poplar, and when in full bloom the branches and catkins appear to cover the trunk from the ground upward. The wood is darker and somewhat harder than that of the Aspen, or Cottonwood Poplar.

## THE DOGWOOD

*Cornus*

CORNACEÆ, the Dogwood family, comprising twenty-five or more species, are natives of Europe, Asia and North America, and are among the most beautiful of the trees or shrubs that adorn the landscape, from the time they put forth their snowy or pinkish blossoms in early spring, until their bright berries ripen in the autumn, and the foliage takes on a brilliant scarlet crimson and gold; and, even before the leaves have fallen, the forming of the little round buds gives assurance of the next year's bloom.

Many of the family closely resemble one another, the blossoms of each variety growing in spreading clusters. Their chief difference is in their leaves and fruit and in their size, which ranges from the dwarf shrub of the Bunch Berry, the smallest of the family, to the Flowering Dogwood, which is the largest of all.

The inner bark of the tree is very bitter, and has medicinal properties of a tonic nature, similar to Peruvian bark, for which it is sometimes substituted. The Indians used the bark of the roots for making a scarlet dye. The wood of the Dogwood is hard, fine grained and susceptible of a high polish. It is used in the manufacture of many small articles, both useful and ornamental, its close grain rendering it capable of a beautiful satiny finish. The earliest description of Dogwood was given in Ray's "Historia Plantarum" (1686-1704).

*Alternate-leaved Dogwood—Cornus Alternifolia*

THIS species produces a vigorous growing tree, reaching a height of from eight to twenty-five feet. It is indigenous to North America, and is found in every latitude, growing along country lanes and along river banks and borders of woodland. The reddish-brown bark is smooth or somewhat broken in irregular ridges; the yellowish-green branches are streaked with white or light green; the leaves, alternate, are clustered at the ends of the branches, and are ovate, entire, and long-pointed. It blooms in early May and June.

The odd little flower, with cream-white spreading petals surrounding its four stamens, grows in broad, open clusters of many tiny flowers crowded together. In October, when the fruit ripens, the bunches of dark blue berries, drooping from their reddish stalks, present a most pleasing contrast to the other varieties of fruit and the



brilliant foliage of the autumn glory. An old-time legend credits the farmer with watching the Dogwood tree, in the belief that the unfolding of the leaves was a sure sign that the time had come for planting corn.

*Flowering Dogwood—Cornus Florida*

THIS is the most beautiful of all the Dogwood family. In its native soil, and with the favorable surroundings of a southern climate, it will attain a height of thirty-five or forty feet; in the colder North it frequently appears as a shrub. The profusion of its flowers gives it its specific name, *Florida*. It grows in woodlands and rocky thickets and by woody roadsides, from Maine to Florida. It particularly abounds in New Jersey and Pennsylvania, and in Maryland and Virginia where the soil is moist. In Florida and the Carolinas, it is found only where the soil is gravelly. Its special characteristics are: dark reddish-brown bark; shining branches; leaves opposite, ovate, entire-edged, a bright green above, paler underneath and pubescent; flowers large, white or pinkish. A large white involucre, divided into four distinct parts, rounded and notched at the tops, somewhat heart-shaped, simulating a corolla, surrounds the clusters of small greenish-white flowers.

A nectar, hidden in a disk on each little ovary, attracts numberless small flies, bees and butterflies; later in the season, the flowers are replaced with oval bunches of egg-shaped, scarlet berries, which remain on the trees until the winter birds, finding little else to satisfy their hunger, devour the fruit and scatter the seeds far and wide.

The Flowering Dogwood well repays cultivation as an ornamental tree, the showy white blossoms, as well as the bright berries, producing a charming effect against the green foliage. Before the leaves are fully developed, the blossoms unfold, and, covering the tree in their profusion, may be seen from a long distance, as if reaching out their snowy hands in joyous welcome to returning spring.

## THE SUMACH FAMILY

*Rhus*

THE Sumachs stand apart from other trees and shrubs, and exhibit a distinct individuality. Everyone, observing or unobserving, knows the rich, red, velvety-looking trees and bushes scattered along the highway. The smooth, dark-brown bark has a soft look, as if it were not so compact as that of other trees; the branches are curiously blunted at the ends, instead of tapering to a point; the

branchlets and leaf-stalks, velvety, with a thick crimson down. The leaves are very showy. They are compound, oddly pinnate, with from eleven to thirty-one leaflets; alternately arranged, with stout, reddish petioles. In the autumn, the leaves assume the richest maroon tints, and the most brilliant crimsons and scarlets to be found in the foliage of trees. The flower clusters, too, are conspicuous. They occur in upright panicles, usually dense, but varying somewhat in different species. The panicles are more showy when the small, five-parted flowers have been replaced by crimson or purplish drupes. These drupes are almost dry, and contain one seed each.

Some of the Sumachs are poisonous; and those which are harmless are looked upon with suspicion by many persons who cannot distinguish between the species. The common Poison-sumach may be known by a little blade-like projection on each side along the petiole. This plant is a relative of the Poison-ivy, or Mercury-vine, which contains a similar poison. Both these plants, while highly poisonous to many, do not affect others at all; they will even affect a person at one time and not at another, as his general condition renders him more or less susceptible.

Species of Sumach are indigenous to each of the continents except Africa. The Smooth Sumach (*Rhus Glabra*) is a shrub common in the eastern part of the United States. It grows in rocky or barren soil. The smooth leaves are white underneath. So far from being poisonous, the crimson drupes of this species contain a refreshing acid.

The Venetian Sumach (*Rhus Cotinus*) unlike most of the genus, is simple leaved. These leaves are rounded at the end, and have long, thick petioles which do not leave the branch until severe frost kills them, long after other deciduous trees are bare. It is a native of southern Europe and western Asia, but some think it also indigenous in Arkansas, where it is found on the rocky bank of the Grand River.

The Canadian Sumach (*Rhus Canadensis* or *Rhus Aromatica*) is a straggling bush found in Canada and the United States, having sweet-scented leaves.

The Stag-horn Sumach (*Rhus Typhina*) is either a shrub or a small tree, picturesque on account of its irregular branching. It grows in eastern North America, sometimes attaining a height of forty feet. The little branches and stems are especially downy in this species. The drupes are bright crimson. Because of the acidity of these and the twigs, this species has been called the Vinegar Tree. The pith is easily removed from the young shoots, which are sometimes thus converted into pipes through which to draw maple



sap. The wood of this tree is valued for inlaying, because of its handsome, satiny appearance. In color it is yellow, streaked with green.

The Coral Sumach (*Rhus Metopium*) found in Florida and the West Indies, is known as the "poison tree." It gets the first name from its pretty scarlet berries.

An interesting species is the Laurel Sumach (*Rhus Laurina*) of California. This is a large, leafy shrub, with many and spreading branches, emitting a pleasant, aromatic odor. Both this and the *Rhus Integrifolia* form dense thickets along cliffs near the sea, in California. Both these and a few other species have simple leaves, as indicated in the Latin name of the second.

There are many other species which need not be mentioned here. Nearly all of them are useful for tanning leather, and for the making of dyes, of which both black and yellow are made from it. The *Rhus Vernicifera*, of Japan and Nepal, yields a juice which is used for varnish. The *Rhus Venenata*, a poison Sumach, has a similar juice which might be employed in the same way were it not for its harmful properties. This tree is so poisonous that its baneful properties are not eliminated even by burning the wood to charcoal. The *Rhus Radicans*, of North America, and some other species, are cultivated for medicinal properties.

## THE LOCUST

### *Robinia Pseudacacia*

THIS is one of our handsomest shade trees. Tall, slender, with upright branches, graceful foliage and beautiful blossoms, it is rarely passed unnoticed. The reddish-brown bark is rough and ridged. The young tree is protected by thorns until it attains a diameter of four or five inches, but these disappear later. The leaves are curiously pinnate, having from eleven to twenty-five oval leaflets, smooth, and very thin and fine in texture.

A glance at the *papilionaceous* blossoms will tell that this tree, fifty, sixty, perhaps eighty feet high, is a relative of the little pea-vine; they both belong to the order *Leguminosæ*, or Pulse Family. These flowers grow in long, loose racemes from the leaf-axils. They are pure white—except at the base of the standard, or largest petal, where they are yellow—and are extremely fragrant. Often the air for some distance about is laden with their perfume, and one looks for the tree long before one's eyes have espied it. The fruit is a legume or pod, narrower than that of the pea, containing similarly from four to six seeds, brown in this case.

The Locust was the first American tree introduced into Europe. Linnæus named the genus *Robinia*, in honor of J. Robin, the French botanist, who received and cultivated it about the year 1601. The wood is very valuable. It is hard, light, close-grained and durable; in fact, it hardens with age, instead of decaying. Because of these qualities it is valuable in shipbuilding, but is used in connection with other woods, as it is difficult to obtain Locust timbers of desirable size. The tree is found from Pennsylvania southward to Georgia, and westward.

The Clammy Locust (*Robinia viscosa*) is a smaller tree than the preceding, sometimes only a shrub, and is found from Virginia to Georgia. The branchlets and leaf stems are clammy, hence its name. The flowers are pink and showy, but they grow in more compact racemes, and less graceful than those of the False Acacia; neither have they the delightful fragrance of those flowers. It is not common growing wild, but is often cultivated.

The Rose Acacia, or Bristly Locust (*Robinia hispida*), is a showy shrub found in the South, and frequently seen in cultivation in the North. The flowers are large and of a deep rose color. The legumes are covered with bristles.

## BEECH FAMILY

### *Fagaceæ*

THE Beech is thought by many to be the most beautiful of trees. Its leaves are rarely eaten by insects or spotted with disease. In early spring, when the half-opened leaves are a shining mass of soft green and white, it is no less charming than in midsummer, when the abundant foliage lies in shelving masses upon its branches, causing a dense shade. And in the autumn, even after the leaves, turned to a golden yellow touched with russet, have fallen to the ground, the tree is not shorn of all its beauty, for it then shows to advantage its beautiful silvery-white bark, its strong trunk, and the structure of its closely interwoven branches. In the Southern Hemisphere there are several evergreen species, and traces of *Fagus* in cretaceous rocks show it to have once existed in a large territory from which it has now wholly disappeared.

### *American Beech—Fagus Ferruginea*

THIS is the only one of the Beech trees native to America. Like all the family, it has alternate leaves, almost entire and feather-veined,



light green when young, later becoming a dark green, paler underneath, and in autumn turning to a clear golden yellow. The bark, as well as the leaves, is of a lighter color than the European varieties and is very smooth. It is a large tree, frequently reaching a height of from sixty to one hundred feet, and has firm, light-colored, close-grained wood.

The fruit of the Beech grows in a prickly bur inclosing two triangular, sharp-edged nuts, which are opened by the frost, the burs hanging on the trees the greater part of the winter. The meat of the nut is very sweet and pleasant to the taste; and a favorite autumn pastime of the young people in New England some years ago was to make up beech-nutting parties, as soon as the frost had sufficiently loosened the nuts, and, climbing into the branches, shake them until the little fruit came down in showers to be gathered for use in the long winter evenings.

*Purple Beech—Fagus Atropunica*

THIS variety of Beech is native to Europe. It has the darkest leaves of any deciduous tree; they are of a reddish or purple cast, are almost entire-margined and, having very short leaf stalks, sway but little with the moving of the branches. Individual trees of the Purple Beech have been found at different times in the forests of Europe, but it is believed that the most of those cultivated are derived from a tree discovered about two centuries ago in a forest in Thuringia, which is supposed to be more than two hundred years old and is still alive. Mention was made of Beech trees with red leaves, in a natural history published in 1680.

The belief of the Indians that Beech trees were never struck by lightning, evidently adopted by the early settlers of this country and handed down to the farmers of the present day, has been confirmed by scientific experiments. These have proved that the Beech is less affected by electric currents, or resists them more vigorously, than the oak, ash and some others.

## THE HAWTHORN

THERE are several varieties of this well-known tree. It belongs to the apple family, bearing a small, not very palatable fruit. It is usually planted in hedges, its long thorns making it effective for the purpose. Given room and proper nourishment, it will attain a height of twenty or thirty feet, and is very long-lived. The

white-flowered variety is fragrant in bloom, but the red blossoms of another variety have a disagreeable odor. In southern Europe and western Asia there is a shrubby species bearing a red fruit larger than that of the ordinary haw, and used around Jerusalem for preserves.

## THE APPLE FAMILY

### *Pyrus*

THE Apple, that well-known and wholesome fruit, is included with the Pear, the Quince and the Mountain Ash, in the genus *Pyrus*. The common Wild Apple or Crab-tree, with its small and hard fruit, is the parent of all, or nearly all, of the varieties of the Apple. Cultivation has wonderfully improved the original fruit.

It is to the Romans that we owe the first systematic cultivation of the Apple. They produced at least twenty different varieties (Pliny mentions that number), and introduced it during their occupation of Britain. From Britain the early settlers brought the fruit to America. It found favor with the Indians and was spread by them all over the continent.

The varieties of the Apple are beyond accurate counting. The tree itself is not beautiful in comparison with some of those of the forest, but the wild Crab-apple, especially in the springtime, when it gracefully bears its burden of bloom, has a beauty peculiarly its own, and the fragrance of its white, rose-tinted flowers is most pleasing.

The Apple-tree usually has a diameter across its head greater than its height. The branches are rigid, irregular and low; when loaded with the ripe fruit they are borne almost to the ground, and frequently so great is the burden that whole branches break away from the trunk. Twenty to forty feet embraces the average height of the Apple-tree. The tree is usually long-lived, many specimens bearing fruit after they have passed their two-hundredth year. As a fruit tree, it requires a fertile soil and a sheltered situation. The countless ways in which the excellent fruit can be used are well known. The bark of the Crab-apple yields a yellow dye; it also has medicinal properties. The Apple itself is one of the most nutritive and agreeable of fruits. The wood of the Apple-tree is hard, durable, and fine-grained, light brown in color. It is much used by turners and is a favorite wood for shoemakers' lasts.

The Common Apple (*Pyrus malus*) includes all varieties of the cultivated orchard tree. It is a flat-topped tree, averaging thirty feet in height, and throws out its white blossoms, tinged with pink, in



May. The fruit ripens from August to October, according to the variety and the climate. It flourishes in temperate climates; extremes of cold and heat are unfavorable to its growth. In China and India it is cultivated, but not successfully, for the fruit is sparse and poor and the trees die quickly. The Apple has a large commercial value and in America its cultivation is an important industry. In one form or another, fresh, dried, or as preserves, American Apples are to be found in all parts of the habitable globe.

#### *The Crab-Apple*

THE wild Crab-apple (*P. coronaria*) of North America is supposed to be the parent of all cultivated apples. The tree is always small, in fact it usually has a stunted appearance. The bloom is well known as the daintiest and most fragrant of all apple blossoms. Its petals are of an exquisite pink on the outside, and curve inward more than those of the ordinary apple. The fruit is small, very smooth and shining, green when wild, but highly colored in cultivation. It is somewhat acrid and has a peculiar flavor; nevertheless it is relished by many persons, and is considered good for preserving.

The Mountain Ash (*P. Americana*) is in no way connected with the Ash proper, but is a close relative to the Apple and the Pear. It is a graceful shrub, growing to a height of fifteen to thirty feet in swamps and mountain woods, in the northern parts of the United States. It has showy clusters of small, bright red berries, which ripen in autumn and remain on the branch into the winter. It is often cultivated for ornament.

#### *The Pear*

THE Pear (*P. communis*) is half-sister to the Apple, and, like it, is largely cultivated for its fruit. It is usually a taller tree than the Apple, frequently growing under cultivation to a height of from forty to sixty feet. There are many varieties of the Pear, and the fruit differs greatly in size, form and substance, according to the variety, soil and climate.

"The man who plants a Pear is planting for his heirs," is an old saw relative to the slow growth of the tree, but it is a much exaggerated one. This tree bears fruit in a few years, and its ultimate life may run into the hundreds. We have on record Pear trees over four hundred years old.

The Pear-tree is pyramidal in shape and grows upstanding or as a wall fruit, according to the manner in which it is planted. The bark is smooth and the branches are often thorny. The thorns, however, generally disappear under careful cultivation.

California, Georgia and Florida supply the best American Pears. The Sickel is a distinctively American variety and, although somewhat small, is unsurpassed for sweetness and flavor. The Bartlett is also much grown in the United States.

## THE WILLOW

### *Salix*

THE Willows as a family are known in science by the name of *Salix*. There are one hundred and sixty varieties of this tree, of which not more than half a dozen thrive in the United States, although local customs have given single species many names.

The Willow varies in height. Sometimes it towers ninety or one hundred feet high, and sometimes it is a pretty shrub. The Pussy Willow and the White Willow illustrate the peculiarities of this plant. The whole family love the banks of streams, and the timber furnishes tough, light wood adaptable to the manufacture of baseball bats and such robust instruments, while the soft and pliable osiers are twisted and woven into baskets, chairs and numerous other familiar articles of household use. The union of lightness and strength in the Willow, the close grain of the wood, and the uniformity of its fiber, make this tree very valuable in the commercial arts. In nature, it fortifies river banks against erosion, ties the soil, and gradually builds up embankments against floods. Tonics are distilled from the barks of some species, and others furnish a greater percentage of tannin—the vital principle of the tanner's curing acid—than the oaks.

The Willow always appeals to the sympathies of poets. In spring the catkins peep from the buds with the first warm breath. The trees seem to glow with a natural radiance. The tender little leaves clothe the slender branches, and even the long, sweeping twigs are gorgeously painted with new-born verdure.

### *The Weeping Willow — Salix Babylonica*

BOTANISTS deny that the American Weeping Willow is a descendant of the trees under which the Hebrews wept. They say "Fancy associating its pendulous branches with the hanging of harps!" The Hebrew, Psalm cxxxvii., says: "We hanged our harps upon the willows in the midst thereof." There is nothing absurd in this statement, and the beautiful history of the introduction of the Weeping



Willow into Europe and the United States goes far to support the biblical theory.

Alexander Pope, the poet, bought a country home on the bank of the Thames at Twickenham. A friend in far-off Smyrna sent him some dates. Within the drum-like bundle was an interesting twig. The poet planted it on the river's bank. It rooted and grew. It was the mother of all the Weeping Willows in Europe and America. The staminate, or male tree of this species, has never been imported. Hence this beautiful tree must always be propagated by slips deliberately cut and planted or detached during storms, and left to the chances of nature. Alexander Pope lived until 1744, long enough to admire the graceful tree whose ancestor swayed its long threads of branches beside the irrigating canal of a desert date grove. In 1775 a young British officer bound for America took with him, for the sake of "Auld Lang Syne," a twig of Pope's Willow. He presented the slip to Mr. Custis, the stepson of George Washington, who planted it near his home at Abingdon, Va., whence sprang the generations of American Weeping Willows. In 1790 General Gates, taking leave of his commander's family, procured a slip of this tree, and planted it at the entrance to his farm near the New York City of those days, on the spot which is now the intersection of Third Avenue and Twenty-second Street. For many years this tree was known as Gates's Willow. Thus the Weeping Willows of the United States link themselves with ancient Babylonian rivers and the pathetic story of the homesick Hebrew.

The Weeping Willow varies from thirty to sixty feet in height. The bark is gray and rough. The branches are greenish, very long, drooping and supple. The leaves are pointed at both ends and saw-toothed entirely around. The Hoop Willow (*Salix Babylonica annularis*) is a variety of the Weeping Willow, recognizable from its leaves, which curl and recur into rings.

#### *The Black Willow — Salix Nigra*

THE bark of the Black Willow affords an extract efficacious in allaying fevers. The tree attains a height of from fifteen to thirty-five feet. It ranges from New Brunswick to California and southward. The bark is blackish or light brown, rough and flaky. The branches are yellowish brown, slender, and so brittle at the bases, that they are easily detachable. This circumstance accounts for the fact that for a considerable distance from a Black Willow grove, a trail of detached trees is to be found. Storms carry away slips, which, falling upon springy or spongy ground, take root and thrive. The leaves of this tree are about two inches long, and the under side is paler than the light green upper surface.

*The Western Black Willow — Salix Amygdaloides*

THE Western Black Willow is also known by the names Peach-leaved Willow and Almond Willow. Its habitat extends from New York to Ohio, and westward to Missouri and New Mexico. It is a small species, growing from fifteen to fifty feet high, and rarely attaining the latter altitude. The osiers of this tree are much used for basket-making. The catkins are very beautiful. They bloom in April and May, and throw out masses of little cottony bulbs or tufts. The leaves are smooth, and the under surface is slightly paler than the upper. This tree thrives in Canada, from Quebec to British Columbia, and is especially luxuriant along the shores of the Great Lakes. It takes its names of Almond and Peach Willow from the shape of its leaves. It is also called the French Willow in some localities. The trunk grows at an incline over the streams, and the pliable branches curve upward.

*The Shining Willow — Salix Lucida*

THE Shining Willow is a native species of Willow shrub. It rarely exceeds twenty feet in height and is usually about twelve feet high. It is also known as the American Bay and the Glossy Broad-leaved Willow. The foliage seems almost to have a peculiar attraction for the sunshine. The light loves to shimmer through its quivering leaves. This plant is also recognized by its profuse bloom. Often more than one hundred pods have been counted on one catkin. Of the millions of seeds which are detached from the pods, very few germinate and become Willow shrubs.

*The Brittle Willow — Salix Fragilis*

THE Brittle or Crack Willow is another valuable species used in basket-making. The withes of this plant are long and pliable. The tree grows to a height of sixty or eighty feet, and the head is bushy and irregular. The branches are easily detached from the main stem, a peculiarity of all basket willows. Its home is Europe and Asia, and in the United States it is a naturalized foreigner. It is grown principally in Massachusetts, New Jersey and Pennsylvania. A hybrid of this tree is said to contain more tannin than the best oak bark. The bark is gray and slightly rough; the branches greenish, tinged with red, and more brittle at the base than those of any other of the Willow species. The leaves taper at both ends, and the saw-like edges are uneven, but very well defined.



*The White Willow — Salix Alba*

THE White and the Huntington Willow are the same. This is the giant of the Willow family, and the tree often towers one hundred feet. The trunk is thick set and the branches have a tendency to ascend. The twigs are olive green, not yellowish. The leaves retain, after maturity, the white, velvety hairs on the lower surface, thus giving the tree its name. This tree is also a naturalized citizen of the United States, and at present is to be found in New York, Pennsylvania and New Jersey. It is a good timber tree and its charcoal is very valuable, among other uses, as the best basis for gunpowder. This tree, although introduced into the country artificially, has escaped cultivation and is rapidly spreading through the country as a wild forest tree. It is very beautiful in appearance, especially when a light wind causes the silver sheen of the under surface of the leaves to flash through the greenery, with the radiance of light.

*The Diamond Willow — Salix Cordata*

THE Diamond Willow grows along the banks of the Missouri and Yellowstone rivers. Remarkable diamond-shaped scars are found on the trunk and branches. These are due to the arrest of wood growth at the base of atrophied twigs or branches, which have decayed at the base and dropped. This species is worked into very beautiful canes.

*Bebb's Willow — Salix Bebbiana*

BEBB'S WILLOW is also known as the Long-beaked Willow and the Ocher-flowered Willow. It is found from Hudson Bay to New Jersey and westward. It is a native American plant. It is named for the botanist who discovered and classified it. It is one of the earliest bloomers of the springtime. Scarcely has the sap begun to move under the bark, when the little flower buds make their appearance and glisten in contrast to the bare and bleak earth. This tree grows to a height of from four to twenty-five feet. It establishes itself along the borders of woods, and is frequently found growing in dry ground; although of course its best development is along the banks of streams. The bark is dark green or reddish, the branches yellowish and the twigs take on a reddish brown tinge in harmony with the trunk. The leaves taper to a point and are rounded or wedge-shaped at the base. They are smooth, and of a dull olive green above and beneath of a pale bluish green and covered with silky hairs.

## THE BIRCH FAMILY

*Betulaceæ*

THIS family is somewhat numerous and widely spread. It is found in New England, the middle states, southward and westward among the mountains, especially in the Alleghanies, as far as Georgia. Michaux, one of the early observers of our forest trees, found Birches, and especially the Black or Sweet Birch, very abundant in Nova Scotia, as far as Newfoundland, throughout Maine, Vermont, the middle states and the Alleghany Mountains.

This Black or Sweet Birch, which is also often called Cherry, from the resemblance of its bark and leaves to those of a cherry tree, is esteemed the chief of the family, because of its beauty and value in manufacture. It is easily distinguished from the others by the dark color of its bark. In outline it is like an egg, with pointed apex and heart-shaped base. Its leaves are simple, sharply pointed and double toothed, from two to four inches long and about half as wide. When young, they are silky haired, but become smooth when grown, except on the ribs beneath. The tree rises from thirty to sixty feet in height, with many slender branches. The bark, at the trunk, is a dark chestnut brown and becomes rough in old age. The branches are smooth and dotted with white spots, and in color both leaves and twigs resemble the garden cherry-tree. Both foliage and bark are aromatic and sweet to the taste. The beauty and fragrance of this tree have been immortalized by the poet Bryant, in his lines on "The Murdered Traveler":—

"The fragrant Birch above him hung her tassels in the sky,  
And many a vernal blossom sprung and nodded careless by."

Early in spring the Black Birch expands its long blossoms, which hang like tassels of purple and gold, filling the woods with fragrance, when most things in nature are still half sleeping. It is also among the first trees to put forth leaves. When growing in moist soil, on mountain sides and overhanging the banks of streams, where it thrives best, it sometimes reaches a height of seventy feet, and from the length and slenderness of its tortuous branches, it presents the form of a weeping tree, and one of the most graceful of this kind.

The wood of the Black Birch is hard, fine-grained and of a reddish tint. It is used in fine cabinet work, often in place of the more valuable black cherry. The ease with which it is wrought, added to its strength and durability, renders it a suitable wood for artistic work.



Its natural hue is a delicate rose which deepens with exposure but never turns black.

The age of the tree shows in circles in the grain of the wood, giving rich, clouded effects which have been called by the trade "landscape appearance." It is used in fine cabinet furniture, for chairs, polished head and footboards of bedsteads, for backboards in carriages, and because of its durability, for yokes. It is also highly esteemed for fuel; next, indeed, to the rock maple of the Green Mountains. The bark, when steeped and used with copperas, makes an excellent and durable dye for woolen cloth, the shade a deep brown, bordering on wine color. The special botanical name of the Sweet or Black Birch is *Betula Lenta*.

#### *The Yellow Birch—Betula Luttea*

THIS member of the Birch family grows most freely in New England and Canada, more rarely in the middle states and region of the Alleghanies. It is one of the most valuable of non-evergreen trees. Its outline, like that of the Black Birch, is egg shaped, the top is pointed, the base narrowing to a heart shape. Its leaves are simple, edged very sharply and coarsely toothed. They measure about four by two and one-fourth inches; thin, downy when young, growing smooth with maturity. The leaf stem is short and downy; the ribs straight. The outer bark of the trunk is thin and silvery yellow, and separating into narrow curling ribbons splitting outward at the ends. The twigs and bark are sweet and aromatic, but less so than those of the "Sweet Birch." In moist woods it reaches a height of from forty to eighty feet. Like the Black or Sweet Birch, it yields an enormous amount of sap—more, perhaps, than any other tree. While young it is apt to be slender and of a bottle-green shade, but when older its branches take on a copper or polished golden bronze tone. With this metallic luster, come horizontal dots on the outer epidermis, after which the bark begins to peel in frayed curling ends; growths intersperse themselves, making black and white cloud-like effects. In very old trees, the trunk becomes rough, with large dark scales, separated by furrows. In deep woods these furrows give lodgment to moss and liverwort growths. The Yellow Birch is often found seven or eight feet in circumference. The roots swell out above the ground in curiously fantastic shapes.

When the leaves first come out, they are covered with hair. They appear in twos, on short, curved, hairy footstalks. They are more or less egg shaped, tapering toward the point and contracted at the base, which is heart shaped, and are more coarsely serrated than

those of the "Sweet Birch." On the green, hairy, growing shoots the leaves are alternate, with short, taper, lance-like stipules, which soon fall off. In autumn the leaves become a soft, pale yellow.

The fact that Yellow Birch has not been much cultivated for ornament has occasioned comment. It has much beauty. In its natural state, its soft, drooping, abundant foliage, and its light bronze trunk, with mingled silver and pearl lusters, suggest how much more beautiful it might be made under cultivation.

Its wood is very useful. Bending more easily than that of the Sweet Birch, it is much used in the manufacture of many articles of furniture. It is also used for casks, staves and sometimes for floors. It is counted among the valuable fuel-woods.

*Red or River Birch -- Betula Rubra*

RED Birch, which is also called River Birch, is somewhat different in aspect and character from the other Birches. It has, however, the egg-shaped outline, but this breaks sometimes into diamond form. Its base is often pointed, or blunt and wedge-shaped. The trunk's bark is reddish brown, bursting, as the tree grows, and hanging loosely in shreds of varying shades. The young twigs are downy. It is the only Birch that grows at its best in warm climates. It is found on low ground along river banks, from Massachusetts westward and southward, and becomes common in the lower part of New Jersey. It reaches a height of from thirty to fifty feet, with branches long, slender, arched and often drooping nearly to the ground.

The leaf stem is short and downy; the leaf is about three inches long by two inches wide; whitish, downy beneath, and in autumn turning yellow. The color of its loose bark is a light red, and the trunk, in old trees, a dark gray. The wood is close grained and very hard and durable. It has not been much used in the arts, but as fuel it has been rated next to hickory. The negroes of the South used to make bowls and trays of the wood, and from the young stocks of branches, hoops for rice casks. Of late it has been used somewhat in the manufacture of furniture, for which it has every quality needful. Birch brooms are made from it, especially the large ones used for streets and court yards.

*Paper or Canoe Birch -- Betula Papyrifera*

OUTLINE, egg shaped; apex pointed; base, rounded or slightly heart shaped. Leaf stem, downy. Leaf, two to three inches long, dark green, smooth above, dull beneath, with ribs hairy, especially in their



angles. It is native to New England, and to the mountains of Pennsylvania, and grows northward farther than any other non-evergreen tree, except the aspen. The bark is very tough, thick, and durable. It is snow white on the outside, easily removed from the wood, and can be peeled into many paper-like sheets, the inner part being of a reddish tinge. It grows from forty to seventy feet high. The wood is hard and very close grained, but decays more rapidly than that of any other of the Birches. Indeed, the wood has often been found rotted within, while the bark was perfect on the outside. This wood has been very largely used in the manufacture of spools, shoe lasts and in many kinds of turnery; for the making of wood pulp and above all for fuel.

But the most famous and interesting use to which this tree has been put is the manufacture of waterproof canoes, for which its bark is used. Every one will recall Hiawatha's incantation to the Birch-tree in Longfellow's famous poem:—

“Give me of your bark, O Birch tree!  
Of your yellow bark, O Birch tree!  
Growing by the rushing river,  
Tall and stately in the valley!  
I a light canoe will build me,  
That shall float upon the river,  
Like a yellow leaf in Autumn,  
Like a yellow water Lily.  
Lay aside your cloak, O Birch tree, . . . .”

The Canoe Birch is one of the most picturesque of trees. It has certain differences of habit, but in general character is similar to the Birches already described.

*White Birch — Betula Populi Folia*

THIS has been known by various names, as Oldfield Birch, Gray Birch, Silver Birch, Cutleaf Birch, etc. It is a native of New England, and thence extends somewhat more northward, but rarely farther southward than Delaware and Pennsylvania. It is a graceful and beautiful tree, although it is short-lived and seems to seek, by choice, poor soil. It has the airy lightness of the Birch family in general, and spreads out its glistening leaves on the ends of very slender pensive sprays. It has a peculiar soft and tender grace; though not as beautiful as the European White Birch, which the poet Coleridge called “The Lady of the Wood.”

It grows from twenty to thirty feet high, with more slenderness of spray and leaf, than has any other of the Birches. Its bark is chalky

white and thin, but, unlike that of the Paper Birch, does not separate easily. This bark is marked with blackish dots and lines. The branchlets and twigs are sometimes blackish and in young trees the bark is reddish brown. The tree is somewhat triangular in form, and the outline of its leaf is of similar shape. The whole foliage suggests feathery lightness.

The tree is valuable for the rapidity with which it grows on any kind of soil. As fuel, it does not rank as high as the other Birches, and is used mostly for the kitchen where a quick fire is needed, or for kindling wood. In former times it made a valuable charcoal for the forges.

The Dwarf Birch is a pretty little shrub about two feet high, which is found in New England and Canada, as far north as Hudson Bay, and in mountainous regions as far south as New Jersey and Pennsylvania. It grows best in wet meadows and on the slope of mountains.

## THE HICKORY TREE

### *Carya Hicoria*

THE Hickory family (*Carya hicoria*) includes some of the most shapely and useful forest beauties. Tall, standing from sixty to one hundred and twenty feet high, the strong branches of the Hickory swing gracefully, like a splendid, leafy tiara. It abounds from Maine westward and southward to Florida and Texas. The swampy lowlands, the mountain sides, and the level floor of the woods, all love to rear these handsome trees as pillars in the aisles of the forest cathedrals. The Hickory is hardy; the wood is tough and strong,—good for fuel and useful for timber. The fruit of some specimens is delicious, and the wood itself exhales a pleasant fragrance, whether in its native beauty or furnishing warmth for a winter's evening, while its nuts are being cracked and eaten with a sauce of reminiscence from the last vacation.

The principal kinds and names of the Hickory-tree — *Hicoria* or *Carya* — are the Mockernut (*Hicoria alba* or *Carya tomentosa*), the Pignut or Broom Hickory (*Hicoria glabra*), the Shellbark (*Hicoria laciniosa* or *Carya sulcata*), the Bitternut (*Hicoria minima* or *Carya amara*) and the Shellbark (*Hicoria ovata* or *Carya alba*). These will be discussed in groups.

The Bitternut (*Hicoria minima* or *Carya amara*), or Swamp Hickory, grows nobly upon swamp borders or in low, wet woods. Its range extends further northward than that of any other of the Hickories



and it is found abundantly in the forests of Canada. A height of fifty, seventy-five or a hundred and twenty-five feet is often reached by this tree. This species has a broad crown and upright branches. It blooms from May to June, according to latitude, holding back its tender greenery in the South, and being of more rapid growth in its northern wilds.

The beauty of its foliage, varying from a brilliant vermilion through the yellows to tender green, makes it as worthy, as it is susceptible, of cultivation. It owes its sunset tints to many small golden glands, which lie on the under surface of the leaflets. The bark of this tree is a light reddish brown, separated into thin, close flakes, like scales. The leaves show a well-defined but sharp, saw-like edge, and are smooth on both surfaces, or very slightly hairy on the under side. Its fruit is large and rounded, soft and thin. The husk splits half way to the middle, but the kernel is extremely bitter. The wood is not of equal commercial value with other Hickories, but is, however, very pliable and makes good hoops and ox yokes. On the hearth, it gives a bright snapping flame, and is a good fuel for cozy winter evenings.

The Mockernut, also known as the White Heart Hickory, the Shagbark, and the Small-fruited Hickory, flourish in the richer forest soils. The first two range throughout New England, southward to Florida and Texas, and westward in the same latitude. The Small Fruit variety is restricted to a territory from Massachusetts and Delaware, ranging westward.

*The Mockernut or White Hickory—Hicoria Alba or Carya Tomentosa*

THIS tree takes its common name from the deceptive character of its fruit. The hull is large and wholesome-looking, but the husk is thick and pulpy, and the shell hard, dense, and unusually heavy. The nut is from one and a half to two inches in length, and the husk splits nearly to the base, in four sections. The small kernel is indifferently flavored, although it is somewhat sweet. A characteristic of the tree is its large leaf buds. In the late autumn, the buds are covered with yellowish brown scales, which change to hard, slaty gray during the winter. This tree abounds in the forests of the southern states, and is also sparsely found along the Atlantic coast to the Canadian line. The bark is smooth and close and of a light gray color. It produces a tough, strong timber which is valuable in all manufactures where strength is a requisite.

*The Shagbark or Shellbark—Hicoria Ovata or Carya Alba*

THIS tree produces the Hickory nut of commerce, and is sometimes called the White Walnut. The nut is round, growing in a thick, green, smooth, lustrous husk, which opens to the base in four sections. The nut is flattened at the sides and contains a large, sweet kernel. The shell is soft and thin. This tree is a giant among its kind, often towering over one hundred feet into the air. The trunk is slender and column-like in its symmetry. The tree throws high its conical head, and the bursting of its beautiful, petal-like buds is one of the sights of the forest. Its strange, shaggy bark is loosely attached to the trunk, and breaks into long, loose strips, which curve away from the tree, at the bottom, but remain attached to the trunk toward the middle. This tree covers the usual area of the species throughout the country. The fruit ripens slowly and requires a hard frost to mature its full flavor and to open its husks. It bears a heavy crop every year.

*The Big Shellbark—Hicoria Laciniosa or Carya Sulcata*

THIS is a very similar tree to the Shagbark. It grows to the same height, and its light gray bark splits from the tree in thin, narrow plates. The name, however, is derived from the astonishing size of its nuts, which are sometimes known as king nuts. The tree is found in the richer soils of New York and Pennsylvania, and over a wide area westward and southward of these states. It is very slow of growth; its wood is dark in color, and very valuable for manufactures as well as for fuel.

*Small-fruited Hickory—Hicoria Microcarpa or Carya Microcarpa*

THIS tree loves rich soils, but it does not produce a large fruit nor grow to the average height of the Hickories. While the Shagbark and Shellbark rise to one hundred and twenty feet and over, the Small-fruited Hickory rarely exceeds ninety feet in altitude. Yet it is sometimes extremely difficult to tell it from the Pignut. The leaves of both are smooth on both sides and the fruit small. Many botanists regard the Small-fruited Hickory as a species of Pignut. The home of this tree is from Massachusetts to Delaware. The nut is small, smooth, not ridged, thin shelled, and sweet. The leaf buds are very beautiful, although the blossoms are so modest and delicately green that they are often mistaken for unfolding leaves. The wood is valuable; it is light brown and tough.



*Pignut or Brown Hickory—Hicoria Glabra or Carya Porcina*

THIS species of Hickory loves a light, dry soil. It is a lofty specimen and attains a height of one hundred and twenty-five feet. It is native over the widest areas where the Hickories grow, and, its high, narrow crown, and slightly drooping branches, are conspicuous features in forest scenery. It takes the botanical name from the fact that the upper side of the leaf is very smooth; its local name from the character of its nuts, which inexperienced persons sometimes eat under the idea that they are Shagbarks. The bitter, disappointing flavor, once tasted, explains the contemptuous name of "Pignuts." The husk splits only at the top or a little toward the middle. The tree is very common throughout the northern states. Commercially, its wood is valuable, and on account of its strength, toughness, and flexibility is largely used for the handles of tools and in the manufacture of agricultural implements.

## THE CHESTNUT

*Castanea*

THE American Chestnut (*Castanea dentata*) is one of the best-known and most popular of our trees. Although its original home was in Asia Minor, it now flourishes generally throughout the United States. It is an imposing and beautiful tree, of luxuriant foliage. As a shade tree, it surpasses nearly all others, owing to the density of its foliage and the large size of its leaves. It grows rapidly and attains maturity in about fifteen years. At five years of age, it has attained goodly proportions, and begins bearing fruit. When fully developed, it is from sixty to eighty-five feet high. It has a rough, grayish bark and the wood is coarsely but handsomely grained. When immersed in water, it remains sound for a considerable time and, consequently, is much used for piles and submerged work in rivers and lakes. Its wood is reddish brown, and when exposed to the weather, warps readily. It is, however, as an autumn tree that the Chestnut holds a dear place in our hearts. When the russet mantle of August falls on the woods, no tree wears its colors so prettily. The various tints of rich green, golden russet, and delicious brown, all harmoniously toned and touched by the setting sun, show the Chestnut at its rarest. The nut of the Chestnut is edible, and particularly so when roasted. It is said by many that as a fruit-bearing tree for commercial purposes, the Chestnut is as profitable as the apple-tree, and can be counted on to bring its owner larger money returns. There are many sub-varieties of the Chestnut. The nut of

the American Chestnut is smaller than that of the European kind, but it has a sweeter flavor and a finer grain; and perhaps it is because of the difficulty of preparing the smaller nuts that the Chestnut is not as largely used in the family kitchen in America as it is in some European countries. The gathering of the nuts in the autumn affords a popular diversion for old and young. Chestnuts are an article of commerce and when in season are sold not only by dealers, but raw, roasted or boiled, by vendors on the streets of all cities.

The Dwarf Chestnut or Chinkapin (*C. pumila*) is a small variety of the Chestnut. It grows from seven feet to about thirty feet high. The bur bears a single, small, rounded, sweet, chestnut-colored nut, very popular in the South and West. It is a handsome tree under cultivation. It abounds south of central New Jersey and southern Ohio. It is found cultivated farther north.

### *Æsculus*

The Chestnut of the *Æsculus* family belongs to the natural order *Sapindaceæ*. It has broad, digitate leaves, and is of luxuriant foliage. The value of the *Æsculus* family lies more in its ornamental than in its useful qualities, as its timber is too soft for wide commercial uses. The genus is indigenous to North America, the mountainous regions of Mexico, New Granada, Persia, Northern India, and the Malay peninsula. Although the principal member of the family is called the Horse-chestnut, it has no botanical affinity with the Chestnut proper.

The Horse-chestnut (*Æsculus hippocastanum*) is a strikingly beautiful tree, especially in spring, when its leaves are full, and its conspicuous spikes of white flowers, dashed with pink and yellow, stud it thickly. Its outline is pyramidal and is perhaps too regular for picturesqueness, but despite the trimness of its form it is a handsome and impressive tree. Its height varies in different countries. In America it averages forty feet, while in St. Petersburg, Russia, it is kept as a hothouse tree. The boughs spread widest near the ground, converging gradually to the top. Its leaves have long stalks and seven (sometimes only five) obovate wedge-shaped leaflets. It flourishes best in moist, sandy loam, and flowers in May and June. Its fruit has a thickish husk, with strong prickles, inclosing within its valves one or two nuts of a mahogany color. This nut is not poisonous, although so regarded by some. Neither, on the other hand, is it very edible. It has a bitter and disagreeable taste. It is used in many European countries, particularly in France, as a fodder for horses, sheep, oxen and swine.

Authorities differ as to the origin of the name Horse-chestnut. Some say that it was so called because the nuts were used by the



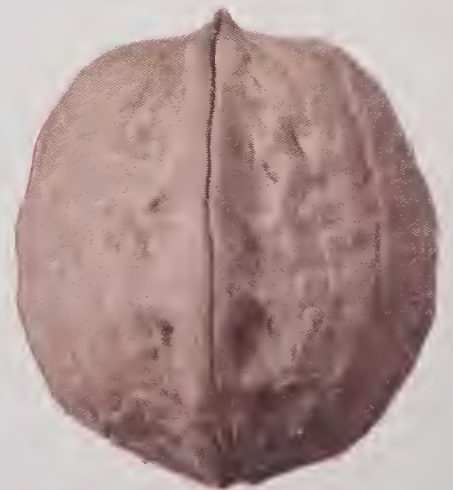
inhabitants of Constantinople, for the relief of short-windedness and cough in horses. This is, however, a mere guess, and a more reasonable explanation is to be found in the comparatively large size of the nut,—horse signifying large. Curiously, the Horse-chestnut is not mentioned in any of the works of the ancient writers.

The commercial uses of the Horse-chestnut are small and few. As in all species of the genus *Æsculus*, the wood is soft, and ill adapted to the needs of the carpenter and turner. Its greatest employment, perhaps, is in the manufacture of artificial limbs and light utensils. The nut is rich in starch, but has not been much cultivated in that direction. The bark contains a bitter principle, useful in tanning and dyeing, and it is sometimes used as a cheap substitute for Peruvian bark. As a park or lawn tree, the Horse-chestnut fulfills its highest function.

The Ohio Buckeye (*Æsculus glabra*) is called Buckeye because of the shape and appearance of the seed, which looks not unlike an eye; it takes the name of the state from the large number of this variety found growing there. It is equally hardy in New England, and is to be found from Western Pennsylvania to Southern Iowa, Central Kansas and Indian Territory, and from Alabama to the lake region. It is found chiefly on the banks of rivers, and on low-lying ground. It is also called the Fetid Buckeye, because of its evil odor. The Ohio Buckeye is smaller than the Horse-chestnut, its average height being about twenty-eight feet. It has narrow, tapering leaflets, unlike the abruptly pointed leaflets of the Horse-chestnut. Its flowers are small and not showy, and of a light green color. Its nut is poisonous.

The Sweet Buckeye (*Æsculus octandra*) is so named because, unlike the other Buckeyes, it is not distinguished by a disagreeable odor. Its range is practically the same as that of the Ohio Buckeye. Each leaf has five to seven shapely, even-toothed leaflets, four to six inches long. The flowers are a dull yellow; the fruit is large, being two or more inches in diameter, uneven, but not of prickly surface. It is a comparatively large tree, frequently growing as high as ninety or one hundred feet. Its wood is stronger than that of any other variety of Buckeye.

The Red Horse-chestnut (*Æsculus rubicunda*) is the most beautiful of the *Æsculus* family. It has flowers of a warm pinkish red, which, against its foliage of rich green, give a delicious softness of color and tone. Other varieties of the *Æsculus* family are the *Æsculus Pavia*, or Red Buckeye, a tree little larger than a shrub, distinguished by its bright red flowers, and the *Æsculus octandra hybrida*, or Purple Buckeye.



Life-size.  
Filbert  
Peanut.

Pecan.  
Hickory nut.  
English Walnut.

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## THE WALNUT

*Juglans*

THE Walnut (*Juglans*) is an extensively cultivated tree, of the same family as the hickory. It is found in southeastern Europe, and in the north of India. Many varieties of the species are native to North America. It is a large, spreading tree, from forty to sixty feet in height, with a massive trunk. It is slow of growth and somber in appearance. Its great market value as a timber tree has been the cause of its destruction at the hands of the lumbermen, and many large tracts of land once covered with Black Walnut are now bare. As the trees take nearly a century to mature fully, there is every prospect of the demand exceeding the supply. Indeed, this handsome tree is now quite scarce. Its wood is highly prized, being heavy, hard, strong, easily worked and of a rich, brown color. It is a favorite wood of the cabinet-maker and the wood-carver.

The European Walnut (*J. regia*) is better known here as the English Walnut. It produces the sweet nut found so plentifully on the fruit-stands, and is also a highly esteemed timber tree. The shell of the nut is rough but thin, and incloses the kernel in a number of connecting compartments. The seed gives forth an oil called Walnut oil, which is used as a table oil and also by painters. After the oil is expressed from the nut, the seed is used as food for cattle. Prior to the introduction of mahogany, the Walnut was the favorite cabinet-maker's wood.

The Black Walnut (*J. nigra*) is a native of North America, and is found on rich bottomlands and hillsides in the eastern states. It is a taller tree than the *Juglans regia*, growing from ninety to a hundred and forty feet in height and frequently having a trunk five to seven feet in diameter. The nuts are not in as great favor as the nuts of the English variety, being closely confined to the husk and difficult of access.

The Butternut (*J. cineria*) is an American tree, and derives its name from the nature of the oil contained in its seed. It is also called the White Walnut. It is an unkempt tree, with naked, sparsely-leaved branches, and resembles but is somewhat smaller than the Black Walnut. It possesses an agreeable fruit and a valuable wood. The latter, although soft, is close-grained, and for interior work is much used by cabinet-makers.



## THE ALDER

*Alnus*

LET us not countenance those — and there are some — who speak slightly of the Alders. Theirs is no small share in the beauty of those charming swamp thickets that we pass along the railroad, or on the banks of streams; nor do we agree that this little shrub merely sets off the brighter plants. The common Alder (*Alnus glutinosa*), under favorable conditions, grows as high as forty or fifty feet; nevertheless it usually has a shrubby appearance in the spread of its branches. The bark is green and shiny, the leaves broad and irregularly toothed, dull green above, white and downy below, the pubescence, or growth of down, largely disappearing with age.

Winter is hardly gone before the reddish brown catkins, which have been all winter waiting impatiently to burst from their buds, are swaying in the breeze. They are so long and flexible that they respond to the least breath, and are very graceful. An interesting fact about these catkins is that they are formed one season, but do not develop until the next.

*Alnus rugosa*, the smooth Alder, is, like the preceding, either a shrub or a tree. It seldom grows singly, but forms little thickets along the banks of streams, its favorite home, although it is sometimes found on moist hillsides. There is a slight pubescence, or growth of down, on the young twigs.

*Alnus incana*, speckled or hoary Alder, is common in America. A beautiful species called *Alnus cordifolia*, or heart-leaved Alder, is native to Italy.

The wood of the Alder is prized for work which must be submerged, as it resists the action of water. Mill wheels, piles, and the like, are often made of it. The supports of the Rialto, at Venice, and many buildings on the canals in Holland, are of Alder. The charcoal produced from this wood is valuable in the manufacture of gunpowder. In the bark is an astringent juice used in making dyes. The bark is also used for tanning.

## THE ELM

*Ulmus*

THE Elm is a tree of the order *Ulmaceæ*, natives of temperate climates, deciduous, with an outline obovate or heart-shaped. It has straight-veined serrated leaves, unequal at the base, and small flowers in clusters which appear before the leaves. The fruit is a small compressed, one-seeded nut, winged all around.

The Elm has a wide geographical range, being natural to practically all of Europe, the west of Asia and North America, from Florida to the northern part of Canada. Chinese nurserymen use it largely for dwarf trees, as it can easily be dwarfed by certain methods of cultivation, while retaining all the other characteristics of a forest tree.

The Elm is esteemed as furnishing a good, cheap, and serviceable hard wood, and also for its beauty and dignity. Some of the Elms of finest appearance are to be found in America. Their lofty trunks reach three-fourths of their height; then start the diffused and pendulous branches, waving gracefully in the air. Where a line of forestry, at once stately and picturesque, is required, landscape gardeners choose the Elm. Hence it is that we see those magnificent, silent sentinels so often ranged along the broad sweep of an avenue, or giving shade to a quiet street.

The wood of the Elm, wherever found, is durable in water or when kept perfectly dry, but is liable to swift decay from exposure. It is subject to the ravages of a boring worm, a circumstance which limits its usefulness in certain directions; but it is valuable to wheelwrights, ship makers, and joiners, because of its fine grain and the rich mahogany color it can be made to assume. One of its most notable qualities is that it wears smooth. On this account it is useful for printers' and dyers' rollers, "dead-eyes," etc. In the United States, Elm of certain kinds is valued for its medicinal properties.

The American or White Elm (*Ulmus Americana*) has leaves from two to four inches long, of oval outline, with abrupt, sharp points. It is the most striking of all Elms, being taller than any of the other species. The fruit is about half an inch long, with sharp, uncurved points. It is called the White Elm, from the tender white of the bark. One hundred feet is not an unusual height for this tree; sometimes it towers as high as one hundred and fifty feet. It abounds in the basin of the Mississippi, but is not by any means confined to that region. It has a wide-spreading top, and its diffused branches and drooping branchlets give it a very ornamental appearance. The wood of the American Elm is not esteemed as highly as that of the English variety, as it is inferior in hardness and compactness, and by reason of its liability to split. It is largely used for piles, dock gates and engineering work generally, where its durability under water gives it value.

The English Elm (*U. campestris*) has leaves of a smaller size and darker color than the American Elm. It is a tall and graceful tree, but the branches grow out from the trunk more abruptly and the tree takes on a pyramidal appearance, not noticeable in the American



varieties. Although called the English Elm, it is not a native of Britain, but was introduced from the middle of south Europe and the Barbary States. It grows rapidly and attains a height of from sixty to ninety feet. It is a centenarian tree and in its old age has a diameter never more than five or six feet. There are several varieties of the English Elm, and many of them are in cultivation in the United States. It loses much in weight by drying, after being cut, and shrinks or warps readily, but, on the whole, its wood is highly regarded for its strength, toughness and closeness of texture. As it does not splinter, like oak or ash, when hit by shot, it is used extensively for gun-carriages.

The Wahoo or Winged Elm (*U. alata*) is a small tree, rarely exceeding forty-five feet in height. It is remarkable for wings of cork with which its branches are furnished on two opposite sides. It flourishes principally in the southern states. The wood is compact and heavy.

The Slippery or Red Elm (*U. fulva*) has large leaves and a tough and durable red wood, and grows from forty-five to sixty feet in height. It is found as far south as thirty-one degrees north latitude, and in the western parts of Canada. The leaves and bark yield an abundant juice, which is bland and demulcent, and is esteemed a valuable remedy in such affections as catarrh and dysentery.

The Scotch or Witch Elm (*U. Montana*) is the best timber tree of all the Elms. The wood, although more likely to split than that of the English Elm, has the peculiarity of growing straight and even, and possesses great longitudinal strength. There are a number of varieties of this Elm, many of them picturesque and graceful. The most remarkable of these sub-species is the Weeping Wych or Witch Elm (*U. pendula*), so called from its spreading, drooping branches.

The Cork Elm (*U. racemosa*) is a large tree with fine-grained, tough, heavy wood. Thick plates of cork cover the branches. It grows best on river banks in Vermont and southwestward to Missouri.

## LIQUIDAMBAR

### *Styraciflua*

THIS magnificent member of the Witch Hazel family is found in low woods in Connecticut and southern New York, and southward and westward to Florida, Illinois, Missouri and Mexico. In the middle states it is seldom found away from the coast.

As a forest tree, its maximum height is one hundred and fifty feet, with large, winged branches that have corky ridges. Its bark is very

rough and the tree is rich with resinous sap, which exudes a gum that is spicy and fragrant. The leaves are simple, alternate, with slender stems, and cut into five deep curves, giving the leaf a star-like appearance; they are finely serrated, brilliant, smooth and lustrous, with tufted ribs beneath.

As soon as the summer wanes, the leaves begin to turn a deep crimson. The flowers are of two kinds, sterile and fertile; the former are erect and spreading, in numerous small, greenish heads. The fertile heads are long and drooping, and borne at the base of the sterile ones. The fruit holds to the tree all winter.

The brilliant, shining, autumn leaves are the tree's greatest beauty; and when a spray is brought home from the woods, the closest inspection seldom reveals a worm-eaten spot on the foliage. Insects are shy of the tree and even refrain from marring the wood. The leaves contain tannin. Its fragrant amber fluid (which is the literal translation of the tree's generic name) is very valuable and is used as a substitute for storax. It is the only tree of its species in this country.

In the South it grows to an enormous height, and in beauty of outline is unrivaled. Every year it is being more extensively planted northward. The wood is brown, not very strong, and warps sometimes in drying; yet it has often been used as a substitute for black walnut.

## WHITE CEDAR

### *Cupressus Thyoides*

THE two species of Cedar, *Cupressus thyoides* and *Thuja occidentalis*, or Arbor Vitæ, have sometimes been confounded, each having been designated as White Cedar. They are similar in habit, both being evergreen, and the branchlets of both are formed in open, fan-shaped sprays. The leaves of both the Arbor Vitæ and the White Cedar are scale-like in formation, adhering closely to the twig, and so overlapping each other that they seem a part of the twig itself, but those of the White Cedar are finer, measuring only about one-half the width of those of the Arbor Vitæ. The cones are a distinguishing feature; those of the White Cedar are small, yellowish brown and round, opening toward the center when ripe, while those of the Arbor Vitæ are oblong and composed of six or eight loose scales.

The White Cedar is especially fond of swamps, crowding out as far into the water as possible, but it will also grow in dryer soil,



and there are said to be twelve varieties in cultivation; it is a good tree for ornamental use, growing symmetrically. The wood is very durable for purposes where it comes in contact with moisture, and has a pleasant aromatic fragrance.

## THE LARCHES

### *Larix*

AN EXCEPTION to a rule always interests, even if it does not actually please. A person or thing with an individuality stronger than the family or race characteristics that we expected to find, arrests our attention immediately. Among such evergreens as the pines, cedars, spruces and firs, to which it is allied, the dainty Larch challenges our notice by declining to wear her summer garment through the winter.

This beautiful tree, under favorable circumstances, sends its straight stem to a height of fifty or sixty feet. The lowest branches almost lie on the ground, from which the tree tapers gradually to a point. The bark is a bright reddish brown, rather scaly; the color of the young branches is first green, changing by degrees to a dark brown as they become older. The branches of the Larch are slender and pendulous, with whorls of light green leaves; they are pretty indeed. These leaves are linear, like those of the pine, but shorter, being never more than an inch and a half long. The red blossoms come in May with the leaves. The cones are dainty little things, less than an inch in length, of a bright chestnut color. Unlike the pendent cones of the hemlock, hanging from the tips of the twigs, these grow along the branch, set close to it. There they remain until the second year.

The American Larch, Tamarack, or Hackmatack (*Larix Americana*), is found throughout British America, as far as the arctic circle, venturing into only the most northern states of the United States. Its chosen habitat is in cold, deep swamps, where it often forms thickets. It will also grow on dry land. The long, tough, flexible roots of this tree are mentioned by Longfellow; Hiawatha begs the Tamarack for some with which to bind his canoe. Another of the many names of this species is the "Black Larch."

The European Larch (*Larix Europæa*) is a native of the Alps. It is largely cultivated in England and in America. It differs little from the Tamarack of America, the leaves and cones being, perhaps, a trifle longer, the branches a little more drooping. The wood of the tree is very tough, elastic and durable. It is used largely in house-building,

for boats, and especially for things which must be under ground or under water. The bark is medicinal; it is also used for tanning and dyeing. Venetian turpentine, too, comes from this tree.

Other species of the Larch are the *Larix occidentalis*, of Pacific North America; *Larix griffithii*, the Himalayan Larch, which has a soft, yet durable wood; the *Pinus laricio*, or Corsican Larch, and the *Larix* (or *Pseudolarix*) *koemfferi*, Chinese or Golden Larch.

## THE OAK

### *Quercus*

**D**R. EDWARD H. GREENE gives the following definition of an oak:—

“The Oaks, for which, as a genus of trees, botanists continue to use the name *Quercus*, are all easily recognized by the peculiar kind of nut-like fruit which they bear, and which is called in our language an Acorn. Every one knows that a kind of round or egg-shaped, cylindrical, elongated, thin-skulled nut, the base of which is set in a scaled or tubercled cup of circular outline, is an Acorn, and whatever tree or bush produces Acorns, is an Oak. Thus the Bearded Live Oak of the South, the gnarled giant of the northern woods and the Chinkapin bush, are brothers and sisters.”

The Oak is also described as a slow-growing, dicotyledonous tree, of a peculiar spreading habit, and which loves a deep, tenacious loam with rocks in it. There are three hundred species of Oak in the world, of which fifty belong to North America.

The Oak is one of the most stately trees. Strong, sturdy and massive, the branches spread from the main stem with a peculiar jagged outline. The sudden shoots and angular twists of the branches resemble the zigzag path of a lightning bolt.

On this fantastic but majestic frame is spread a luxuriant foliage of glossy leaves. These are deeply cut and serrated so that the wind moving the tree brings out an added beauty. All the shimmering mass of green is finely edged in all its parts, and the huge bulk presents a filmy, lace-covered appearance. The great tree is rounded, and true in its exterior lines. The crown of green is usually flattened on the top, and the massive trunk, upbearing the wide-spreading branches, is true in its proportions.

The Oak attains its greatest beauty in the open. When growing in the unobstructed sunshine, its habit of spreading its great arms abroad, so that the birds of the air may rest in its branches, is unhampered. When situated at the edge of a forest, it irresistibly reminds the beholder of a noble and sturdy sentinel. Within the depths



of the woods it grows to greater height, and gradually shouldering aside less robust plants, it spreads out and covers a remarkable area. When shaded during its early growth, it shoots upward toward the light, and under these circumstances frequently attains a height of more than one hundred and fifty feet. When thus towering aloft with its extended crown, the glossy leaves changing color with every light and every breeze, there is no monarch of the vegetable world more worthy of homage.

The young Oak has one very interesting peculiarity. When the stem shoots up, the buds of leaf and branch arrange themselves in a very orderly manner. Each of the green leaves arises from a point on the young stem, which is a little higher and more to one side, than that from which the lower one springs. Hence a line joining the points of insertion of the successive leaves and future branches, describes an open spiral around the stem or young trunk. This is continued around the young tree, so that coming to the sixth leaf in the spiral, it is found in a line directly vertical to the first shoot or base leaf from which the count started; and the spiral has passed twice around the stem.

The Oak has another peculiarity. Some of the species mature the fruit or Acorn in a single year. Others require two years to complete this process of nature. All Oaks are very slow of growth, and live for hundreds of years.

The Oak is not the heaviest, the toughest, strongest, or the most pliable wood, but it combines all these qualities in such just proportions that its value as timber cannot be overestimated. At one time all war ships were built of heart of Oak. As early as the year 1799, the government of the United States spent two hundred thousand dollars to purchase tracts of live-oak land. It held these forests at the command of the Navy Department until the year 1895, when an act of Congress was passed throwing this valuable land open to the public. The demonstrated fact that all vessels in the future would be constructed of steel made these vast forests valueless to the government, but from the sturdy oaken timber of these lands such splendid ships as the victorious "Constitution," the "Hartford" and hundreds of others had been built.

A cubic foot of good oak timber weighs about sixty pounds. Mahogany, cypress and other woods are much heavier, but no timber has yet been discovered which combines such a general average of good qualities as the Oak. It is stiff and unbending under pressure, but, when properly steamed, will bend to any shape the shipwright or carpenter may require. It was this workable quality which gave Oaken timbers their immense value to shipwrights under the old methods.

It is still immensely valuable in building. Piers and under-water work constructed of Oak will last for years. In the British Museum is a section of one of the piles of London Bridge that was submerged for a period of six hundred and seventy years.

The principal varieties of American Oak include many species which scientific botanists have separated into distinct groups and named, but for all practical purposes the following matter describes the families of the Oak with sufficient accuracy to permit the amateur to recognize the various species.

*The White Oak — Quercus Alba*

THE White Oak is so termed from the color of its wood. The bark is a light gray or nearly white, and smoother than that of most Oaks. It often breaks away from old trees in thin sheets. The leaves are large, wedge-shaped at the base, with from three to nine lobes in each leaf. These are very deeply incised, the cuts in the leaf following the main ribs of the leaf skeleton back almost to the main stem. They are bright green above and paler below. The Acorns grow in pairs on short stems.

The Acorn cup is saucer-shaped, shallow and rough. The nut is green; turning to a lustrous chestnut; it is oblong, from three-quarters of an inch to an inch in length, and the meat is sweet and edible. In the spring, the great gray mass puts forth leaves as tenderly pink as the shyest wood-flower; these, during the summer, are bright green; in the autumn they become bright red. The forms of the leaves vary greatly; often two or three distinct forms are found. The White Oak makes valuable timber. It is largely exported to Europe in the form of barrel and cask staves. It is also important in ship and carriage building.

*The Red Oak — Quercus Rubra*

THE Red Oak differs broadly from the White, or the Scarlet Oak. Under favorable circumstances, it is a magnificent tree, often reaching a height of one hundred and fifty feet. The outline of the leaf is very variable, and the lobes or parts are small and unequal in size, and are bristol-pointed. This gives the tree a very light, airy appearance, although the foliage is dense. The Acorn is characteristic, and serves well as something by which the species may be identified. The nut is remarkably large in proportion to the cup. It is long, and is bitter.

The timber from the Western Red Oak is superior to that of the Eastern. It makes a fairly good barrel-stave or clap-board, but is not one of the more valuable Oaks. The bark is reddish brown,



rough, and broken into scales, but like that of the White Oak is smooth for an Oak. The leaves are dark green, smooth on the upper surface, and pale yellow-green beneath, with rust-colored leaves in the angles of the ribs. The wood is reddish brown. Both the White and the Red Oak grow throughout the United States.

*The Scarlet Oak—Quercus Coccinea*

THE shortcomings of the Scarlet Oak are atoned for by the fact that in autumn the foliage blazes into a brilliancy of exquisite red, displaying the most delicately tinted garment of any of the Oak family. Its range is from New England southward and westward, and it is the glory of the autumn forests. The bark is grayish brown and rough, with a reddish inner bark. This tree is highly prized for cultivation on account of its autumnal beauty. It thrives best in sandy, light, dry soil, and often grows beside the Black Oak.

*The Black Oak—Quercus Velutina*

THE Black Oak differs from its companion, the Scarlet Oak, in a manner that may aid to distinguish them. The Black Oak assumes such various forms of foliage that frequently it resembles the Scarlet Oak; but the Acorns are smaller, and of a bright yellow, while the Scarlet Oak produces a white-meated nut. The bark of the Black Oak is dark brown, appearing black in the distance, while that of the Scarlet Oak has a grayish hue. The inner bark is deep orange, never reddish or gray. The budding leaves are red and turn to a silvery green in summer. In autumn they are red or russet, without a touch of the Red Oak's beautiful scarlet.

The Black Oak lifts a narrow head not more than a hundred feet high, and is not so stately as other varieties. The leaves frequently lose their bristles at maturity, giving the leaf a blunt appearance not consistent with its earlier forms. The Black Oak yields a well-known dark dye, Quercitron, and a large amount of tannin.

*The Spanish Oak—Quercus Digitata*

THE Spanish Oak is found from New Jersey southward. It takes its Latin, or scientific, name from the appearance of the leaf, which is long and slender, breaking into pointed lobes resembling fingers. The leaves vary much in form, even on the same tree, but they are always downy underneath. The upper surface is smooth. The Acorn is small and the cup shallow. This tree loves the coast countries, and seems to prefer for its habitat low gravelly places, and barren land.

As far north as New Jersey it does not attain height or dignity equal to those of its southern representatives. It is frequently to be found side by side with the Swamp White Oak. It is one of those Oaks which require two years to ripen their Acorns. Its timber is not regarded as valuable except for fuel.

*The Swamp White Oak—Quercus Platanoides*

THE Swamp White Oak is found from Maine to Iowa, and southward to Delaware and Georgia. Its greatest development is attained in the neighborhood of the Great Lakes. The brown bark separates into thin scales, and hangs down from the larger branches and sometimes from the trunk, giving the tree a remarkable appearance, which, once seen, can never be forgotten. The wood is light brown, strong, and closely grained; it has about equal commercial value with that of the White Oak. The Acorn is oval, chestnut color, and about an inch long. It is edible and sweet.

*The Willow Oak—Quercus Phellos*

THIS remarkable tree is found from Long Island, N. Y., southward and westward, and there is nothing, at first sight, in its appearance to denote that it is an Oak. The tree has leaves like a willow, and it is not until the Acorns appear that its family is distinctly shown. It retains its leaves green and fresh long after other trees have shed their foliage. For this reason it is much cultivated in the South. The Acorn is small, but perfect.

It is a very handsome tree. The bark is reddish brown and almost smooth, although it has very close scales. The foliage is a brilliant, light green. The tree grows in moist woods, or sandy uplands, and on the borders of swamps. It will be a pleasure for the amateur to identify this tree as an Oak. The Acorn will be about the only sure guide, but once seen, it will not be forgotten.

*The Laurel Oak, Shingle Oak or Water Oak—Quercus Laurifolia*

THIS Oak of many names is found from Pennsylvania to Iowa, and southward to Florida. The leaves are long oblongs, pointed at the base, and bristle-tipped. They are bright green, smooth and glossy above, and show a slight down on the under surface. This tree does not attain the usual height of the Oak, rarely growing more than eighty feet. Its trunk is tall and shapely, and the laurel-like foliage is very lustrous. The Acorns are small, the cup saucer-shaped, and the scales compressed. Its name of Shingle Oak connects it with the principal purpose for which its timber is used.



*Post Oak — Quercus Minor*

THE Post Oak is another species known in different localities by various names, such as Iron Oak, Box White Oak, and Round-leaved White Oak. Its range is from Massachusetts southward, and westward to Indian Territory and Texas. The height of this tree varies from twenty to one hundred feet, and this peculiarity is one of its most remarkable traits. Indeed, in New England, this tree frequently becomes a mere shrub. The rough appearance of the plant indicates all the rugged strength of the Oak. Its dark foliage is disheveled and bristling.

The timber is very valuable, especially for railroad ties, cooperage and shipbuilding. It vies with the White Oak as a valuable commercial wood. It is frequently seen growing with the Black Jack. Its name of Post Oak indicates one of its most useful properties, as suitable for gate and fence posts.

*Black Jack or Barren Oak — Quercus Marylandica*

THE Black Jack is a characteristic Oak, although it rarely reaches a greater height than fifty feet. In the spring the leaves open beautifully pink on the upper side. In the summer they are dark and lustrous, giving the plant its name of Black Jack. The wood shrinks badly in seasoning, and consequently is used principally for fuel, for which purpose it is commonly reduced to charcoal.

*Chestnut Oak — Quercus Prinus*

THIS tree is also known as the Rock Chestnut and Swamp Chestnut. It is distinctively an Oak, bearing a perfect Acorn, but the leaves resemble those of the chestnut rather than those of the Oak. The distribution of this tree is from Maine southward to Delaware and Kentucky, Tennessee and Alabama.

It lifts a broad, irregular head to a height of one hundred feet, and like the "spreading chestnut-tree," throws wide its arms. It is one of the handsomest and most noble of Oaks. The combination of the Chestnut leaf and the Acorn is sufficiently peculiar for identification.

*Yellow Oak — Quercus Acuminata*

THIS tree, also, is sometimes called the Chestnut Oak. It has, however, a tall, straight, narrow head and grows to a height of one hundred and sixty feet, which altitude is never attained by the true Chestnut Oak. The tree is very beautiful and imposing in appearance. The bark is light gray, rough, and broken into thin flakes. The trunk is graceful and lofty. The long leaves cling closely to the

limbs. In the Atlantic states the leaves resemble the true Chestnut. In the western limits of its range, the foliage is very variable in its form. The tree is found from northern Vermont to Alabama, and westward.

*Burr Oak — Quercus Macrocarpa*

THE Burr Oak also goes by the names of Mossycup Oak, and of Overcup White Oak. These designations indicate a peculiarity of the Acorn, which is very large and handsome, inclosed in a deep cup, covered with rough-pointed scales, the lower row of which terminates in long, bristle points, and forms a soft, mossy fringe about the nut. The nut itself is from one to one and a half inches long. It is oval, and almost covered by the cup.

This noble tree is one of the largest of the Oak family. It grows to more than one hundred and sixty feet in height. Its range is from Maine to Pennsylvania, westward to Montana, and southward to Texas. It forms the famous "Oak Openings" of the western prairies.

The beauty of this tree cannot be praised too highly. The branches begin to spread afar at a small height from the ground, and cover a very wide area. The tree then towers aloft, well clothed in verdure, to the greatest altitude attained by the Oak. In appearance the outline is very graceful,—a wide-based cone of green, supported by a large, shapely trunk, not too high to lift the great mass of leaves and branches disproportionately above the ground. As a timber tree it is almost without a rival. Its dark brown wood is valuable for all the purposes for which the White Oak is sought.

*Pin Oak — Quercus Palustris*

THE Pin Oak is another tree whose characteristics have impressed differently various communities. It is also called the Water Oak, and the Swamp Spanish Oak. The leaves strongly suggest the outline of the Scarlet Oak described above. They are, however, smaller. This tree is found from Massachusetts, southward and westward. It is not a giant, nor yet a dwarf of its kind. It attains, under favorable circumstances, a height of eighty feet or more.

The bark is dark gray, or greenish brown, rough, with furrows distributed very far apart. The outer skin often cracks, showing the reddish inner bark. The leaves are from three to five inches long, and have from five to nine lobes, each of which shows a tooth or bristle at the ends. The foliage is bright green above, and paler below.

Age seems to destroy the youthful symmetry and beauty of this tree. It is one of the few Oaks which droop the branches, although



the natural grandeur of the Oak clings to it until the last. Its coloring in spring, summer and autumn is good, and characteristic of the species. This tree warps badly in drying and is not useful for timber.

*The Chinkiapin — Quercus Prineides*

THE Chinkiapin, or Dwarf Oak, is a remarkable specimen of the Oak family. It grows on a shrub, or small round-topped tree, from New Jersey southward and westward, and is generally found on rich hillsides. The leaves are oblong, and serrate, like a saw. The fruit is a little nut which grows singly within a bur which, when the nut is fully ripe, opens from the top to below the middle of the nut. It is very sweet and edible, and is gathered for sale. It is considered a dainty equal to the chestnut.

THE MAMMOTH TREE OF CALIFORNIA

THE Mammoth tree of California (*Sequoia gigantea*) is the largest of known conifers. It is distinctively American, and is found flourishing only on the California coast. It is of the tribe of Abietineæ, and of the sub-tribe Taxodinæ. The Redwood is akin to it, both being of the same species. The name, Sequoia, comes from an Indian of the Cherokee nation, named Sequoiah, who lived in California, and invented an alphabet, which he taught to his tribe.

The Mammoth is found at its best at altitudes of from thirty-five hundred, to four thousand feet above the sea level. In appearance it is stately, tall, and columnar. The leaves are awl-shaped, short, rigid, with pointed apex, and of a light olive-green. This magnificent shaft of timber literally pierces the heavens. Many specimens over three hundred feet high have been measured. There are records of trees approaching to a height of four hundred feet, but the tallest now known, is one of the Calaveras grove, which is three hundred and twenty-five feet from tip to ground. Another, in the King's River forest, is nearly thirty-six feet in diameter inside the bark, and by its rings is calculated to be four thousand years old. The bark is from twelve to twenty inches thick near the ground. In color it has nearly the same tint as the Redwood, but the wood toward the center is of a deeper and duller red, approaching a brown.

The commercial uses of the *Sequoia gigantea* are not many. The heartwood, however, is dense, hard, and of a fine color; oiled and varnished, it has been used for cabinet work. The tree is not plentiful enough to be of great economic importance. As an example of massive and stately vegetation, the *Sequoia gigantea* is one of the most impressive natural features of the Pacific coast.

## THE REDWOOD TREE OF CALIFORNIA

THE Redwood tree of California (*Sequoia sempervirens*) is a variety of the "Mammoth" tree, and, of all American trees, is next to it in size. It is a coniferous tree, and grows plentifully on the coast ranges of California, but is found in its greatest abundance in the territory lying north of San Francisco.

Its proportions are noble and stately. It usually grows to a height of from two hundred to two hundred and fifty feet, but some have been known to tower higher than three hundred feet. The trunk is straight, cylindrical, and has an average mean circumference of from twenty-one to thirty-four feet. It is naked to a height of seventy to eighty feet, above which point it throws out symmetrical, spreading branches. The bark is from six to twelve inches in thickness, and is, when growing, of a bright cinnamon color.

The wood of the Redwood tree is, as its name implies, of a rich brownish red. After exposure, when cut, however, it gradually fades to a much duller shade. In quality it is light, straight-grained, easily worked, with the exception of a slight tendency to split, and takes a good finish. In contact with the soil, it is durable, and is a useful building timber. On the Pacific slope it is used for a variety of purposes, such as telegraph poles, railway ties, wine butts, fences, etc.

On good and favorable soil the Redwood tree grows with great rapidity, and though it flourishes when planted in the Eastern states, it is hardy only in its native California. The cones of the Redwood are small, roundish, and rarely more than an inch in diameter. The needles are from half an inch to a full inch long. The Redwood is much esteemed as an ornamental park tree.

## THE BANYAN

*Ficus Indica*

THE Banyan, a native of the East Indies and Ceylon, is one of the most remarkable trees in the world. It is, indeed, many trees in one, a grove springing from a single root. The woody trunk rises to a great height, and branches out extensively. Every branch from the main body throws out its own roots, at first in small tender fibers but, as they grow into the ground, they become stronger, and, when they have buried themselves, the stem becomes a fresh, stout trunk which carries further the spreading wood. The tree endures for many ages, for when the parent trunk, after centuries of upstanding,



has rotted, the offshoots of its branches have spread, multiplied, and grown strong.

The Ancients stood in awe of this remarkable tree, the Brahmins, especially, holding it in sacred reverence. One famous specimen of the tree, which is reported to stand on the banks of the Herbudda, has, although much reduced by age and floods, three hundred and fifty large trunks, about three thousand smaller stems, equal to large oaks, and covers an area of two thousand feet in circumference. One of the generals of the army of Alexander the Great described it as standing and flourishing in his day, and related that it gave shelter to an army of over seven thousand men.

Great swarms of monkeys, birds and fruit-bats inhabit the tree. The wood is of no commercial value, as it is soft and spongy, but the Hindoos claim many medicinal qualities for the bark; and milky juice. The tree furnishes lac and caoutchouc.

## THE RED MULBERRY TREE

### *Morus Rubra*

THE Red Mulberry (*Morus rubra*) attains a height of sixty or seventy feet in its native forest, and its trunk is from two to three feet in diameter. This tree grows to a much larger size when planted in open ground, where it spreads its branches so as to make a finer display of foliage. The bark is heavy, and deeply furrowed, and, when the tree has begun to age, is of a grayish brown. In its wild state, the Mulberry has a ragged appearance. It blossoms in April and May, the flowers growing in catkins. The leaves are from three to seven inches long, and coarsely serrated; when young, they are rough on the upper side, and of a yellowish-green color. As they age they become smooth and are bluish green. The leaf ribs are a yellowish white, and very distinct. The fruit resembles the blackberry; it is red when in an unripe state, turning to a rich crimson purple when fully developed. The berries are very sweet; they have a peculiar, insipid, almost sickening flavor, greatly appreciated, however, by the birds, poultry and hogs which fatten upon them.

The wood is finely grained, of a yellow hue, and is said to possess strength and durability. It is used in some of the shipyards of southern ports, in building the upper parts of vessels. In its native regions it is largely used for building rural fences, especially for the posts, as it is said to withstand decay. There is a fiber taken from the inner bark of the Red Mulberry, which is woven into cloth by Indians in the southern states.

## THE PLUM

*Prunus*

THE Plum (*Prunus*) is of the same Rosaceæ family to which belong the other cultivated stone-fruit—the Cherry, the Apricot, the Peach, and the Almond. The Plum, itself, is the most familiar of all fruit trees in the temperate countries. There are innumerable varieties of it, and the fruit varies considerably in size and appearance, but its value as a dessert is reckoned rather by its sweetness and flavor, than by its size. The Plum is a standard tree of the orchard. It is not over fastidious as to soil, but generally prefers a strong, but well-drained loam. The superior species of Plum are propagated chiefly by budding, and by grafting; the inferior, by layers, or by cuttings from the roots. The dried and preserved Plum is called the Prune, and its preparation in this form is an important industry of California, as well as of Germany, and of France. The Prune has many virtues possessed by few other dried fruits, and, as a consequence, its cheapness also being taken into the account, it is esteemed the world over.

The origin of the Plum is in dispute among botanists, though it is generally conceded that all the cultivated varieties are derived from the Sloe, Wild Plum, or Blackthorn, as it is variously called. Another theory is that all Plums are varieties of the common garden plum (*P. domestica*). The common Plum is believed to be indigenous to the south of Russia, the Caucasus, the Himalayas, and to many parts of Europe. In America, it is sometimes found in hedges, but never truly wild. Its introduction to America dates back to the earliest settlement, and since then the gardeners of the United States have originated several valuable varieties of the tree. What is supposed to have been the parent tree, was destroyed by lightning in New York, after many years of barrenness, at the close of the eighteenth century.

The wood of the Plum tree is much sought after by cabinet-makers, turners, and the manufacturers of musical instruments. It is hard, fine grained, and susceptible of a high and lasting polish.

The Wild or Canada Plum (*P. Americana*) is found from Canada to Texas, and it is, perhaps, the best known of the Plum trees of the United States. It is a handsome, showy tree, very thorny in many of its wild varieties, but thornless in some of its cultivated forms. It grows from ten to twenty-five feet high, and has a large, round head. It throws out white flowers in spring, just before, or at the same time with the appearance of its leaves. The fruit, which ripens



in August or September, according to the climate, is from one-half to one inch in diameter, globular, or somewhat oval, and is a charming transparent yellow, red or orange in color. The skin is tough and bitter. The fruit, itself, is pleasantly flavored. The wood is reddish.

The Chickasaw Plum (*P. Chicasa*) is indigenous only in the Southwestern states, but has spread by cultivation throughout the whole country. It is a small tree, or rather shrub, rarely exceeding fifteen feet in height, and is more often only eight or ten feet. It has long, narrow, fine-toothed leaves, and its fruit is from one-half to two-thirds of an inch in diameter. It is well flavored, and many excellent varieties of it are now cultivated. One of the best of these is called, by some nurserymen, the Wild Goose Chickasaw, the legend being that the tree sprang originally from a stone found in the crop of a wild goose.

## THE WILD PLUM

THE Wild Plum is found along the borders of streams, or at the edges of open woodlands. There are two closely allied species which are often confounded. One, the Canadian Wild Plum, is a Northern tree; the other, the American Wild Plum, is found throughout the United States as far west as the foothills of the Rockies. It is indigenous to America. The tree is small, with slender, spreading branches, furnished with thorns. The flowers are like those of the cultivated Plum, which are too well known to need describing. The fruit grows in cherry-like clusters. It is sometimes of an orange color, sometimes red, containing a single, flat stone-seed. The skin is tough and acrid, but the pulp within is edible, and pleasant to the taste. At one time the Wild Plum was much sought after by farmers' wives for preserving

## THE CHERRY

### *Prunus Cerasus*

THE Cherry belongs to the same family as the Plum, the only distinction between them being in the varieties. In fact, the Plum and the Cherry merge readily into one another. They are subject to the same diseases, and present the same botanical features. The Cherry has even a greater number of varieties than the Plum, several

hundreds being recognized in the botanical catalogue. It had its origin in Asia, and it is recorded by Pliny that Lucullus introduced it from Cerasus, in Pontus, to Italy about B.C. 70, to celebrate his victory over Mithridates. One hundred and twenty years later it was introduced into Britain.

In the United States it flourishes greatly, and, every year, millions of trees are in cultivation. The fruit, which may be eaten fresh, dried, or cooked, is pleasant and wholesome, and, besides, is used extensively in the making of liquors, the best known of which are Kerschwasser and Maraschino. Cherry Brandy is made by steeping Morello Cherries in Brandy. Peasants and forest dwellers in some parts of France, use the Cherry as an ingredient in a favorite soup.

The wood of the Cherry almost rivals the mahogany. It is compact, fine grained, and of a dull red tint, which deepens with age. It takes on a brilliant polish, and is used in the manufacture of almost every kind of furniture. Not infrequently it is planted for ornament, as it gives forth a pretty and delicate flower. In China and Japan, it is esteemed exclusively for its flower, so much so that the fruit is entirely ignored.

The Black Cherry (*P. scrotina*) is remarkable for its rapid growth and large size. It grows to a height of from twenty to sixty feet, and some trees have been known over eighty feet high. It is distributed all over the Eastern states, but is at its best in Pennsylvania, Ohio, and Virginia. The fruit is purplish black, about as large as a pea, and somewhat bitter to the taste. The flowers grow in clusters and appear in May or June, the fruit ripening in August, or September. The branches of the tree are scraggy and scattered, but in outline it is a picturesque and attractive tree.

The kernel of the Cherry contains a perceptible amount of Prussic acid which accounts for the bitter aromatic taste of the pulp. The wood of the Wild Black Cherry is the most valuable of all the Cherry woods, on account of the size to which the trees grow, and of the erectness of the trunks.

The Wild Red Cherry (*P. Pennsylvania*), sometimes called the Bird Cherry, is found principally in the northern United States, and is much used for culinary purposes. The fruit is borne in bunches, is translucent, red, and sour. It appears to be relished by birds, hence its secondary name. It is a small tree, rarely higher than twenty-five or thirty feet, and grows chiefly in rocky woodlands. The flowers appear in May, and are small, white, and long stemmed. The Red Cherry often grows in great quantities after forest fires, and covers the otherwise denuded land with a dense growth.



## THE CHOKE-CHERRY

IN APRIL and May, the air in some parts of the country is fragrant for miles around with the odor of Wild-cherry blossoms. These appear on dainty sprays, very different from the ordinary Cherry blossoms. The fruit is, at best, not much larger than the largest cultivated currants. It is deep red, almost black when ripe, often acrid and unpalatable, but, a tree bearing such fruit, frequently stands beside one with cherries much larger, juicier and quite sweet. The flavor is entirely different from that of any cultivated cherry.

The tree itself is graceful and pretty. It grows by the roadside, in field corners, beside streams, and on the edges of woodlands. It springs quickly from the seed, and often a lane is fringed on both sides with Wild-cherry trees, self sown. The juice of the fruit is used for making summer drinks, and for cough syrups.

## THE OSAGE ORANGE

THIS is a remarkably handsome, showy tree. It grows to a height of from forty to sixty feet, spreading out, and gracefully rounded at the top, with handsome foliage. It easily adapts itself to its surroundings, and flourishes throughout the North. Young shoots will grow from three to six feet in a single year; consequently, when planted for hedges, as they frequently are, the trees require constant pruning.

The fruit is a syncarp, that is, it has many fruits in one. In appearance, it is a pale green ball, composed of many small drupes grown together. These are filled with milky juice. The fruit is highly fragrant, but not edible. Cattle eat it, but it is injurious to them.

The name "Osage Orange" is from the Osage Indians, who greatly prized the wood for the making of bows and clubs, because of its elasticity, and remarkable resistance to decay. This wood, which is bright orange in color, is in favor for general use, in locations subject to alternations of dry and wet.

## ORANGES

*Citrus Aurantium*

A RATHER low-branching, evergreen fruit tree is the *Citrus aurantium*, or Orange-tree. Its bark is generally greenish brown, and its leaves ovate. The flowers are white and fragrant. Oranges are large, globose fruit, of eight or ten membranous cells, each containing several seeds, which are packed in a pulp of tapering, bladder-like, cells, distended with an acidulate juice.

There are three principal varieties of the Orange: the sweet, or China Orange,—*Citrus aurantium* proper,—including the ordinary market sorts; the bitter, or Seville Orange,—or Bigarade, variety *Bigaradia*,—used much for making marmalade, its peel being especially valued; and the Bergamot Orange,—variety *Bergamia*,—classed by some, however, as a variety of *Citrus medica*.

The Orange is a native of India, whence it spread to western Asia, thence reaching Spain and Italy between the thirteenth and fourteenth centuries, through the agency of the Moors and the Crusaders. It is now cultivated in nearly all tropical and subtropical lands, including China and Japan, the whole of the Mediterranean basin, the West Indies, the southern borders of the United States, and California.

Of late years, the most noted feature in the Orange cultivation of this country has been the production of the famous Navel Orange in lower California. This variety is seedless, and of a slightly bitter, yet satisfying, taste. At the beginning of the twentieth century, the Washington Navel was the most popular of all foreign varieties growing in California. The fruit of this Orange is large, very juicy and highly flavored. The skin is smooth and of very fine texture, and the fruit is seedless. The tree is a prolific bearer, moderately thorny, and a rapid grower, although it does not attain a large size; it bears when very young, and the fruit ripens early. This variety of Orange was imported from Bahia, Brazil, in 1870, by Mr. W. Sanders, of the Department of Agriculture at Washington, and in 1874 two trees were received from Washington by Mrs. Tibbetts, of Riverside, California. They were soon in fruit, and the excellence of the variety being at once recognized, the tree was propagated rapidly, and the Orange received the name of Riverside Navel. Later, the name Riverside was exchanged for that of the national capital.

Throughout the world, the Orange is, as a rule, grown from cuttings and layers, but the favorite modern method of cultivation, in California and in Florida, is by seed. The seed chiefly used is obtained from cheap seedling fruit. When thoroughly decayed, the fruit is pulped by a mashing process. The mass is then rubbed through a coarse sieve, which catches and holds the seeds. Plump seeds will sink if thrown into the water, while the imperfect seeds rise to the top. The good seed is not allowed to dry, and is sown after the ground has become warm in the spring.

Orange seedlings are grown either in boxes or in the open ground. In either case, a rich, sandy loam, that will not harden, is made by mixing sand with rich garden loam. Boxes about two feet square are made, with holes in the bottom for drainage. The boxes are filled



to a depth of about four inches with the prepared soil, and the seeds are placed four inches apart, each way. They are then covered to a depth of one inch with a sprinkling of soil. The soil is kept moist, and in about six weeks the seedlings appear. During the first season they grow to about one foot in height. Planting in the nursery is usually done in the spring, after the ground is thoroughly warmed. The seedlings are then one year old. Orange seedlings are planted at a greater distance apart than is usual for deciduous trees, because the orange remains longer in the nursery, and because it is often desirable, when taking up the plants, to sack the ball of earth surrounding the roots. If the roots are not to be sacked, there is a space of nine inches between the plants; if they are to be sacked, the distance is made twice as great. In places where horses are employed in the work of cultivation, at least four feet of space between the rows is allowed.

Seedlings are usually budded after two years in the nursery, during which period they are sheltered in the winter, and well irrigated and weeded in the other seasons. The care of budded trees in the nursery is similar to that of the seedlings of the previous year. If too great a tendency to branch low is observed, the tips of the lower shoots are pinched off. About this period the intrusion of gophers and other vermin is carefully guarded against. Budded trees are given one or two years' growth in the nursery, and the same period of growth is allowed for the bud. In orchard planting, the trees are ranged from twenty to twenty-four feet apart. All the varieties now propagated are quick to bear fruit.

In the year ending November 1, 1898, over fourteen thousand carloads of oranges were shipped from California beyond the state line.

#### THE PAPA W

THE fruit under consideration is not the real Papaw (spelled also Pawpaw) of the tropics, but a member of the Custard-apple family, named from its resemblance to the tropical Papaw. The plant is a tree or shrub found throughout the middle states, and as far west as Michigan and Kansas. Dense thickets of it are to be seen along the Mississippi. In rich soil it sometimes attains a height of thirty feet. The trunk is straight, its dark brown bark mottled with gray. The branches are slender and spreading, with leaves from ten to twelve inches long, and four or five inches broad. The blossom is interesting from the fact that it gradually changes color from a decided green, when it first appears in April, to a dark red-purple. The fruit, which ripens in September and October, is oblong,

and so curved as to resemble the banana. Inside, the pulp is yellow and soft, of a peculiar flavor not usually agreeable to the unaccustomed taste; nevertheless, it is often found in the markets of Western and Southern cities.

## CUSTARD=APPLE FAMILY

*Anonaceæ*

THE trees belonging to the genus *Anona* owe their popular name, "Custard-apple," to the custard-like pulp of the fruit. These are tropical, or subtropical trees, varying in height from two to thirty feet, and are indigenous to South America and the West Indies. One species is also found in the United States. This is the three-lobed *Anona* of the southern states, *Asimina triloba*.

The Custard-apple tree has a shining, silver-gray bark and dense foliage. The leaves are alternate, sharp pointed and of conspicuous size, being from ten to twelve inches long. On first leaving the bud they are hairy above, of a rusty color underneath; when full grown they are smooth, dark green above, and a little paler underneath.

The blossom has three sepals and six petals. Three of the latter are broadly ovate, spreading outward; the inner three are smaller and erect. An interesting peculiarity is that these blossoms change color, from green through a brownish hue to a rich purple. Stamens and pistils are many; nectar is secreted in abundance. The fruit is irregularly oblong, rounded, often curved, somewhat resembling a shortened banana. It is called Papaw, from its similarity to the real papaw of the tropics. This species loves a rich, moist soil, and shade rather than sunshine. Along the Mississippi it is found at its best, often forming thickets by itself, or sometimes a dense undergrowth among other trees. In the former case it acquires more tree-like proportions, sometimes reaching a height of thirty feet. It ranges from the shores of the Great Lakes southward to the Gulf, and from the Alleghanies westward as far as Michigan and Kansas.

Two delicious fruits of the order, are the Sweet Sop (*Anona squamosa*) and the Sour Sop (*Anona muricata*) of the West Indies, both juicy and pleasant, the latter possessing a strong acidity. This is cultivated in the East Indies, also. It is a large, greenish, pear-shaped fruit. *Anona reticulata* is the common Custard-apple, good, but not quite so luscious as the two preceding. From its shape it is sometimes called "Bullock's-heart." *Anona cherimolia*, the Cherimoyer of Peru, far excels any other species in flavor.



## THE JUNIPERS

*Juniperus*

THE Junipers, of which there are about thirty species, are scattered throughout the north temperate zone, and in mountain regions farther south. The common Juniper of Europe and North America, *Juniperus communis*, is either a low shrub or a small tree, usually the former. Often it is quite prostrate, the branches spreading along the ground, rooting here and there. It has a soft, reddish bark, smooth in the younger branches, scaly in the older ones. The linear leaves are arranged in whorls of three. They are short, rigid and slightly curved at the base; bright green on the under side; on the upper, glaucous along the center. Like others of the evergreens, the blossoms are composed of whorls of little scales protecting, in the fertile flowers, the ovules; in the sterile flowers, the anthers. They grow in aments, or catkins, from the axils of the leaves. The flattened berry that follows is formed from the three fleshy scales of the flower, enlarged. This is shown by three slight projections, and three lines marking the points and edges of the previously separate scales. The berries are highly aromatic. The volatile oil obtained from them is used in the making of gin, which owes its flavor to them. A variety of Juniper, found in Europe, is valued for its handsome yellowish brown wood, pleasantly aromatic, and capable of taking a high polish. It is used principally by turners for small articles. As a tree, the Juniper sometimes reaches a height of twenty-five feet.

The Red Cedar (*Juniperus Virginiana*) is one of the most picturesque of trees. Its usual height is about thirty-five or forty feet, but it is known to attain to one hundred feet, while, on the other hand, it is sometimes but a mere shrub. It is always scraggy, often twisting itself into fantastic shapes, but its rugged appearance is very attractive. The bark is a reddish brown, scaly, and often falling off in long shreds, leaving the trunk bare and smooth. The wood, from which the tree takes its name, is red, except for a few layers of white sap-wood. It has a most delightful fragrance; is very fine and straight-grained, and takes a high polish. Such a favorite for many purposes has it been, that it is now rather scarce, and correspondingly expensive. It is used for interior finishings of houses, and in general cabinet work; for railroad ties and posts, because it resists decay in contact with the soil; for certain parts of ships, and very extensively for lead pencils.

A distinguishing peculiarity of this tree is that it has two kinds of leaves, the awl-shaped, and the scale-like. Only the former occur in

the young shoots, but on the older branches the two occur side by side. The awl-shaped are furrowed and glaucous above, convex beneath. The scale-shaped are very small and crowded, each bearing a little gland on the outer side. The flowers are similar to those of the common Juniper, previously described. In the fruit, there are no traces of the scales, as in that tree. The cones are about the size of an ordinary pea and purple when full grown. Earlier they are green, covered with a white bloom. They mature, sometimes in the first, usually in the second, season.

The Red Cedar will grow in almost any soil. It is at its best in Virginia. At present the principal commercial supply is from Florida. The tree is frequently attacked by certain fungi. These are often seen in bright-yellow or orange masses, resembling gelatin, with a long, thread-like growth springing from depressions. Savin, a name commonly applied to the Red Cedar, belongs properly to *Juniperus Sabina*, of southern Europe. *Juniperus Bermudiana* is similar to the Red Cedar and is used for the same purposes.

## GINSENG FAMILY

### *Araliaceæ*

THE Aralia, the root of which is so prized by the Chinese as a stimulant, is the *Aralia panax*, Ginseng or Shinseng, a native of northern China. *Aralia quinquefolia*, of North America, is almost identical, but the root is less valued, although it is imported into China from this country as a substitute for the Chinese Ginseng. The commercial product is chiefly from the states of Ohio, Minnesota and West Virginia.

The Angelica Tree (*Aralia spinosa*) is perhaps the best-known American species. As the Latin name indicates, it is a spiny tree. Occasionally it grows from twenty to thirty feet high, with spreading branches, but oftener it is found growing in clusters, not more than ten or fifteen feet high, and almost without branches. These young stems are stout and club-like, hence the common name given to this tree, "Hercules's Club." It has a light brown bark, ridged and broken. The branchlets are prominently marked with leaf scars and furnished with prickles. The leaves are pinnate, *i. e.*, feather-shaped, thus differing from the species mentioned above. These leaves are said to be the longest found on any tree or shrub in this country, frequently measuring three feet.

The Angelica Tree does not put forth its flowers amid the general display, but saves them as a pleasant surprise after other trees have



lost their showy bloom. They appear in July, August, or even September, in large, loose compound panicles borne at the very end of the stem; often rising several feet above the leaves, that the plant may show her belated treasures to the world. The fruit is a little black drupe, which hangs in clusters throughout the winter, unmolested by the birds, which do not find them edible. The fleshy roots of the various *Araliaceæ* are medicinal, but really of little value.

The real rice paper of the Chinese, which comes only from the island of Formosa, is made from the pith of *Fatsia papyrifera*, a member of the order *Araliaceæ*. There is one species of this genus found on the Pacific coast of North America. In addition to this, eight varieties of the *Aralia* are found in our country. The common ivy (*Hedera helix*, or *Hedera nigra*), is also a member of this same family.

## COMMON PERSIMMON

### *Diospyros Virginiana*

THIS is a tree common from southern New England to Illinois, and through the South and Southwest. The roots run to a great distance and produce numerous shoots. The tree frequently grows to a height of sixty feet, and some have been found of one hundred feet, the fruit being high in the branches. The bark is dark colored, deeply furrowed, the ridges crossing like the meshes of a net.

The foliage is bright, the leaves four to six inches long, oblong, somewhat thick, smooth, dark and shining above. The flowers are small and yellowish, and urn-shaped, the staminate ones with mouth nearly closed. The leaves decay quickly after falling and furnish nourishment for the soil, so that the grass near the trees is very luxuriant. The fruit is about the size of a small apple, the flesh soft and pulpy, of a dull yellowish color, very acrid and disagreeable to the taste until mellowed by the frost, when it has a sweet and pleasant flavor.

The wood of the Persimmon is very hard and close-grained, the name *Diospyros* being from a Greek word signifying "grain of Jove." The heartwood does not fully develop until the tree is nearly one hundred years old; it is very dark, almost black, really an ebony, to which general order it belongs. Almost all parts of the tree are useful. The Indians had a way of drying the fruit and making from it a sort of beer, and it is still used in making a spirituous wine. The bark of the root contains a tonic medicinal property, and the wood is used for articles requiring hardness and toughness, such as mallets, shoe lasts and shuttles.

## JAPANESE PERSIMMON

*Diospyros Kaki*

THE Japanese Persimmon is successfully cultivated from Washington, D. C. southward, but in Japan and China many varieties have been produced. In Japan it is found in almost every garden, and horticulturists cultivate it almost as universally as we do the apple, with the result of producing nearly as many varieties. Some of these have been introduced into California and are cultivated; the fruit sent to our Eastern markets comes under the name of California Persimmon. This variety has large, leathery, shiny leaves, and the fruit is somewhat larger than the native American variety. Although semi-tropical, traces of the various species of *Diospyros* have been fossilized in the rocks of Greenland and Alaska.

## THE BANANA

*Musa Sapientum*

IT MAY be a surprise to those not especially interested in botany, to know that the plant bearing this common fruit belongs to the lily family, being quite closely allied to the common iris. The blossom, small, but pretty, is distinctly the six-parted flower of the liliaceæ, and the fruit corresponds to the three-celled pod of the iris, with the seeds in three rows, along the central placenta. But unlike the iris, the Banana has its seeds imbedded in a sweet pulp, which forms the edible part. The plant is usually from ten to twenty feet high, with long, upward-pointing leaves. The true stem is underground, the apparent stem being merely the overlapping lower part of the leaves. Naturally, therefore, it is weak and easily broken down by the violent winds of the tropics, a whole season's crop being sometimes destroyed in this manner. The fruit forms in hanging spikes, with from fifty to one hundred Bananas in a cluster. After it has ripened, the plant dies to the ground, new shoots from the rhizome taking its place. Of these, two or three are allowed to remain, the rest being destroyed or transplanted. It is thought that the undisturbed shoots produce better fruit. Propagation is almost entirely from these suckers, the cultivated fruit being seedless. In a year or two after establishing themselves they begin to flower, the fruit maturing from ninety to one hundred days later.



There are countless varieties of this plant; the two best known being the Banana proper, and the Plantain. The fruit of the latter is larger and coarser, with little flavor; yet it is a favorite food of the natives. In fact, this plant supplies the staple food of a larger percentage of the human race than does wheat bread, our "staff of life." What the potato is to the Irish, what oats are to the Scotch, what rice is to the Chinese, the Plantain is to the natives of the tropics. It is picked green and prepared by baking, boiling, or frying in slices, just as we cook potatoes. The Banana is usually eaten fresh when ripe. Strangers seldom find the Plantain palatable at first, but learn to like it. It is said that the same area of ground that will produce thirty-three pounds of wheat, or ninety-nine pounds of potatoes, will bear four thousand four hundred pounds of Bananas (or Plantains). Humboldt has estimated that an acre of land planted with Bananas will supply a greater quantity of solid food than the same area will yield of any other product.

The Banana is one of the oldest of cultivated plants. Legend says that Adam and Eve reclined beneath it in the Garden of Eden, whence the name that Linnæus bestowed upon the Plantain — *Musa paradisiaca*. Whether or not the Banana was actually the forbidden fruit, as some say, it is certain that the plant was cultivated many centuries ago in the Malay Archipelago, in China and in India. Linnæus called the Banana proper *Musa sapientum*, because of the story that the Greeks of Alexander's expedition saw native "sages resting beneath its shade, and eating of its fruit" in India. The plant grows wild in Cochin China, in the Philippines, in Ceylon and in Khasia. In the wild state it produces seed, and the tough skin, that we know as perfectly smooth, is covered with little sharp or knobby protuberances, or with stinging hairs, a provision of nature to keep off small molesters, which could not help in the dispersion of seeds, as the larger birds and the monkeys do.

There is evidence that the Banana had found its way to America before the time of Columbus. The fruit was offered to Pizarro by the Peruvians; and Banana leaves have been found in the tombs of the Incas. In its wild state, the plant is unknown on the Western Continent. The fruit was brought to the mainland of America from Cuba as late as 1804. The first full cargo, fifteen hundred bunches, was imported in 1830. The annual importation is now more than ten million bunches. Banana-growing is successfully followed in Florida and Louisiana. Those grown in the latter state are especially fine. They are large, red skinned and of a delicious flavor.

The Plantain is useful not only as food, but the stem supplies a fiber which is woven into textile fabrics, and is used in paper-making.





BANANA.  
¾ Natural-size.

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Several varieties are cultivated exclusively for this valuable fiber, of which the best known is the "manilla hemp," grown in the Philippine Islands. Manilla rope is well known, but it is a curious fact that some of the finest Indian shawls are woven from the fiber of the Banana stem.

## THE PINEAPPLE

THE Pineapple is the only important fruit that cannot be traced to Asia as its home. It appears to be of purely American origin.

Its cultivation was at one time confined to certain islands of the Bahama group, but it has now spread to every tropical region where civilized man has made his abode. Dutch traders took it to Holland in the seventeenth century, and it was afterward carried to the southern shores of Asia, the fields of Eastern Africa and the isles of the Pacific. In India, it has escaped from cultivation, and is found in the jungles, where it propagates itself. When not under cultivation, the plant ripens seed from which new varieties may be produced when brought under different conditions. There are several common varieties, which differ in size and in the quality of the fruit, but all have the same distinctive flavor. The common name, Pineapple, comes from the resemblance of the fruit to a pine-cone.

It is related that the Spaniards found the Pineapple in Peru and took it to the West Indies. The Portuguese are said to have been the first to carry it to the East Indies. The Dutch attempted to cultivate it under glass in their cold climate, and succeeded to a marked degree. The same device was adopted in England at one time, but commerce has brought this fruit readily within reach of the civilized nations, and artificial cultivation is not now so extensively practiced.

The Pineapple cannot be called a tree, for the stalk springs from the midst of a tuft of great leaves. A small and curious flower forms on this stalk, from which comes the fruit which is conical in shape, varying from six to twelve inches in length and from three to six inches in diameter. It is always crowned with a tuft of thick, strong leaves. The fruit is really a densely packed collection of berries and fleshy bracts.

The plant can be readily propagated from suckers, or from the tuft on the top of the fruit. Placed either in earth or in water, this tuft will grow and make a good window-plant. Great care must be taken in cultivating the plant, or the fruit will be fibrous, with little sweetness or flavor. By careful cultivation the delicacy and richness of flavor can be greatly increased.



New York is the great mart for this fruit, but it is carried to Europe in an unripe condition by fast steamers and is there matured under glass. It is thought that its quality is much improved by this process. In cold and temperate climates it is generally cultivated in hot houses, in which tropical heat is maintained. The best soil is a rich, sandy loam. When ripened under glass, it is essential to keep the air moist as well as hot, and also to allow ventilation from time to time. The canning of Pineapple is one of the largest industries in some of the West Indian Islands.

## THE GRAPE

THE Grape was known to man at a very early period in his existence, for mention of it comes down to us from the first records of history. Pictures left by the ancient Egyptians, and relics of the Lake Dwellers of Italy and Switzerland, show that the Grape was well known to these primitive peoples. It was certainly cultivated in Egypt as early as 4000 B.C., and the ancient Scriptures frequently speak of the Fruit of the Vine. It seems to have been native to Europe as well as to Asia. It was not known in the British Islands, when they were visited by the Romans, but the vine was soon introduced, and vineyards became valuable portions of Saxon estates. In the twelfth century, a vineyard was attached to every monastery in the south of England.

The Grape is indigenous to America, and much attention has been given to its cultivation. For many years after the settlement of the new country, the only grapes cultivated were of European origin, but slow progress was made in securing good results until the native varieties were taken up. The first of these to attain prominence was the now famous Catawba, which was found wild in North Carolina in 1802. The greatest advance was marked by the appearance of the famous Concord variety, which was produced about the year 1840, by Ephraim Bull, of Concord, Massachusetts. The Delaware Grape is a natural hybrid containing some blood of the European Grape. It was found in a garden of foreign Grapes in 1850, but received its name from Delaware, the Ohio town in which it was first brought to general notice.

The fruit grows upon a woody vine which climbs by tendrils. The leaves have five lobes, and are downy underneath, while the edges are serrated. The flower is of a greenish yellow. The grape vine flourishes all over the world through a wide belt of the temperate zone, and in this country the centers of growth are the middle Atlantic







PEACH.  
 $\frac{1}{2}$  Life-size.

states and California. A high temperature, lasting for a long period is necessary to ripen the fruit.

The Grape is among the most delicious and highly prized fruits of the temperate zone. It is extensively preserved, and is a favorite material for jelly. The Raisin, or Grape in the dried state, is an article of great importance in the household. In central and southern France and in Italy, the chief use made of the Grape is for the manufacture of wine. Southern Germany, Spain and Portugal, are also wine-making countries, but in this industry, no country surpasses France, which produces more than five hundred millions of gallons a year. In Spain and Portugal more attention is paid to making Raisins. The manufacture of wine has become an extensive industry in California also, where several varieties of the Grape grow in great profusion. In all vineyards the vines are carefully trained so as to turn the available space to the greatest account. Superfluous shoots are removed by pruning, that the strength of the vine may be directed into the fruit-growing branches. The bunches of Grapes are generally thinned out, also, in order that finer fruit may be produced.

## APRICOT

**A** TREE of the Rose family, and akin to the Plum tree. It bears an orange-colored, highly-flavored fruit. The tree rises to a height varying from 15 to 30 feet. It can be propagated by grafting on the Plum. It is native of China, grows wild on the Himalayas; and was taken to England by the gardeners of Henry VIII. The tree is now generally cultivated and California supplies the markets of the United States with the fruit both in the fresh, natural state as well as dried and canned.

## BAMBOO

**A** NAME given to a tribe of grasses some of which grow to giant height, the general type of the class being *Bambusa*. They are from 20 to even 120 feet in height and of a diameter of from 4 to 12 inches. The stem is hollow and jointed. It is impossible to begin to enumerate the number of uses to which it is put in Asia; from the making of masts and the building of houses, down to fans and walking sticks. The young shoots are used as food, the leaves as fodder for animals and the making of ropes. It grows in tropical America, Africa and Asia.



## BAY TREE

THIS is the name given to a member of the Laurel family and to a number of other small trees which resemble it; such as the Bay Laurel, the Candle Berry and the Bay Berry. The leaves of the latter are used to make Bay-rum. As the leaves are large and evergreen they are much used in Christmas decorations. It is of healthy strong growth, and it has been adopted as the symbol of victory, excellence, fame, and renown. Simple crowns of bay or laurel were awarded to the victors in the games or contests among the ancient Greeks.

## CAMPHOR

A SORT of gum of clear, translucent appearance obtained from the leaves and wood of the Camphor tree. Its botanical name is *Cinnamomum Camphora*, and is found chiefly in Japan, China and the Island of Formosa. From its timber, clothes chests and cabinets are made. The chips, leaves and branches are distilled in water and the gum camphor is deposited in the upper part of the vessel. The gum has a peculiar penetrating odor and a cooling taste. It is soluble in alcohol, ether and strong acetic acid, but only slightly so in water. In large doses it is poisonous. Borneo Camphor differs slightly from the Japan. Mixed with oil, it forms a camphorated oil. It is sometimes used to prevent the ravages of moths and other insects in clothing and books.

## CHOCOLATE

THE ground seeds of *Theobroma Cacao* made into a paste and mixed with sugar and various spices, and then formed in molds and allowed to harden. It is eaten either solid, or dissolved in hot water, and taken like tea, coffee, or cocoa. When pure (for it is often adulterated and perniciously so) it is a nourishing as well as an agreeable beverage. As a sweetmeat it is used extensively, and forms a wholesome and palatable confection.

## CINNAMON

THE inner bark of a small evergreen tree, with a delicate aromatic odor, found in Ceylon and at Colombo. It is chiefly used in cooking as a condiment and flavoring material, and also in the preparation of some kinds of chocolate and liquors. In medicine it

is used for counteracting the griping action of purgatives. Cassia, the product of a much inferior bark than cinnamon, is sometimes substituted for the latter, and with unsatisfactory results. The Ceylon cinnamon is most highly praised, being of a fragrant odor, and having a sweet, pleasant, aromatic taste.

## CINCHONA

A GENUS of trees or evergreen shrubs, native to the valleys of the Andes, yielding the valuable medicine known to commerce as cinchona, Peruvian, or Jesuits' bark. As a tonic and remedy for fever, owing to the presence of alkaloids, such as quinia, etc., the cinchona is of great importance. The drug is administered in grains in the sulphate or bisulphate of quinine, or in the form of its alkaloid quinine. It is found valuable also as an antiseptic and typical astringent, in addition to its antiperiodic, febrifugal, and tonic properties.

## CLOVES

THESE are the dried, unripe flowers of a species of *Eugenia* found in the Moluccas, Zanzibar, West and East Indies. The tree is an evergreen ranging from fifteen to thirty feet high with large smooth leaves and purplish flowers. The cloves are used as a spice and also as medicine. The essential oil is the Oil of Cloves which is the least volatile of all the essential oils.

## COCAINE

A POWERFUL drug, derived from the leaves of a South American shrub (*Erythroxylon coca*), and used to a large extent as a local anæsthetic. When used internally in moderate doses ( $\frac{1}{4}$  of a grain is a dose), it acts as a stimulant to the brain and to the spinal cord. It is of value also in minor surgery and in diseases of the eye and ear. Its use in excess is disastrous, in bringing on convulsions, and often is fatal. The properties and effects of cocaine, or coca, therefore resemble opium, though less narcotic, while it possesses the property, unlike opium, of dilating the pupil of the eye, and of lessening, in the user of it, the desire for ordinary food.



## COCOA, CACAO, OR COCO

A VALUABLE dietary substance produced from the seeds of a tropical tree, and used as a breakfast beverage as cocoa and chocolate.

The fruit of the tree contains the seeds which constitute the raw cocoa or cocoa bean of commerce. The tree is native to Mexico, to many of the South American countries, and to most of the West India islands. As prepared for a beverage, the seeds or nibs are roasted whereby the fine aromatic substance is formed, and the starch particles are changed into dextrin. It forms a nutritious drink, owing to the soft, solid oil known as cocoa butter, which forms more than 50 per cent of the shelled bean. The rest consists of starch, gluten, albumen, and the principle, called Theobromine, analogous to caffeine

## COCOANUT PALM

ONE of the tallest and most ornamental of the palms, the cylindrical stem rising often to a height of one hundred feet, crowned by a cluster of leaves from ten to twenty feet long. Its fruit consists of a thick external husk or rind, of a fibrous structure, within which is the ordinary cocoanut of commerce. Cocoanut oil is obtained by boiling from the kernels, which are first broken into small pieces and dried in the sun, when they are known as cofra. The oil is also used in the manufacture of marine soap, which forms a lather with sea water. Cocoa stearine, another ingredient, is used in the manufacture of candles.

## CORK

(Latin *cortex*, bark)

THE outer rind or bark of a species of oak (*Quercus Ilex* or *Q. suber*), a native of southwestern Europe, chiefly Spain, Portugal, and southern France, with the islands of Sardinia and Corsica. The imperviousness of cork (its walls are waterproof) to liquids, and its compressibility and elasticity render it suitable for stoppers to bottles and for bungs to barrels; its other important uses are as inside soles, for hat frames, life-preservers, mattresses, false limbs, and for the construction of life-boats. In Spain, walls are sometimes lined with cork to keep out dampness, while, with caoutchouc, it constitutes the material, Kamptulicon, used as a carpet or floor-cloth.











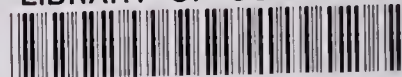








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